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# PER CASE PROSPECTIVE PAYMENT FOR EPISODES OF HOSPITAL CARE

## Final Report

**Prepared for:**

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**By:**

Janet B. Mitchell, Ph.D., Project Director
Russel T. Burge, Ph.D.
A. James Lee, Ph.D.
Nancy T. McCall, Sc.D.

*Health Economics Research, Inc.*

**with:**

L. William Katz, D.B.A.

*Katz & Associates*

Robert Dittus, M.D., M.P.H.
David Heck, M.D.
[illegible]r A. Kinney, J.D.
[illegible] Parchman, M.D.

*[illegible]na University*

Lisa Iezzoni, M.D., M.S.

*Beth Israel Hospital*

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# 1.0 EXECUTIVE SUMMARY

## 1.1 Statement of the Problem

Despite the growing share of physicians' services provided in outpatient settings, Medicare expenditures on inpatient physician services have continued to soar. The major source of this increase lies in growing utilization and service intensity; patients continue to receive more tests, more visits, etc., even after holding DRG constant (Mitchell, 1993). Medicare payment changes over the past five years, namely the Medicare Fee Schedule (MFS) and the Volume Performance Standards (VPS), are unlikely to affect physician inpatient use, as they have left the fee-for-service system intact with no strong incentives to control utilization. Although VPS were intended to help rein in expenditure growth, they are based on collective (all U.S. physicians) rather than individual performance. Most economists are pessimistic that this form of expenditure targeting will succeed in affecting physician performance and controlling costs. (See Rice and Bernstein, 1990, for a detailed discussion.)

Given that more of the expenditure growth is due to increased utilization rather than increased fees, effective cost control requires changing physician incentives to continually increase volume. One solution is to "repackage" inpatient physician services; rather than paying multiple bills from multiple physicians, Medicare would make a single case payment that would cover the entire hospital stay. This, of course, is the physician analog to what Medicare PPS did over ten years ago for hospital care.

Since the inception of PPS, a number of studies have been conducted of the feasibility of reimbursing physicians on a case basis for inpatient care (Miller and Welch, 1992, 1993; Mitchell, 1985; Mitchell and Ellis, 1992; Welch, 1989). These studies concluded that the hospital's medical staff, rather than individual physicians, was the appropriate entity for managing the risk associated with DRG-based case payments.

This project sought to develop and evaluate a per case prospective payment system for inpatient physician services. It expanded on previous work in this area in several key ways:

- With the inception of NCH data, it became possible to evaluate risk based on the complete census of U.S. hospitals (rather than a 5 percent admission sample).
- Payments could be simulated based on a fully phased-in Medicare Fee Schedule (using RVUs rather than transitional Part B payment amounts).

- A complete payment system was developed, including all of the parameters needed to actually implement such a system, including outlier thresholds, per diem transfer payments, etc.
- Extensive interviews were conducted with hospital administrators and medical staff around the country in order to identify administrative problems associated with the implementation of case payment.
- In addition to a case payment for Part B services only, we also developed and simulated a combined Part A and Part B payment.

This latter combined payment has the major advantage of explicitly melding hospital and physician incentives. Physicians would take a clear interest in making the hospital more efficient and vice-versa. They would also share jointly in gains and losses. Even five years ago, neither hospitals nor physicians would have had the organizational structure (or the inclination) to consider such a payment scheme. With the rapid development of physician-hospital organizations (PHOs) and similar entities, however, this approach is now feasible. While PHOs were created primarily to contract with managed care plans (Burns and Thorpe, 1993; Shortell *et al.* 1994), they are equally capable of receiving and distributing Medicare case payments.

## 1.2 Executive Summary

Design and Development of Payment Parameters

In designing the case payment system, we based our parameters on those used in the Medicare Fee Schedule and PPS. Two basic case models were developed: (1) physician services only (PSO); and (2) combined facility-physician services (FPS).[1] Analogous to the hospital PPS standardized amounts and DRG weights, a standardized RVU amount and relative weight was created for each DRG. RVUs were used as the basic unit of value for physician services, rather than dollars, in order to be consistent with a fully phased-in fee schedule.

Both models were developed under two policy options for paying the costs of direct medical education (DME). Current DME payments are intended to cover the salaries and benefits of residents and teaching physicians, as well as some related residency program administrative expenses. Since residents provide patient care services but can not bill

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[1] Since HCFA did not want to re-base PPS, the combined payment model can be simplified as the PSO case payment plus current PPS payments.

Medicare, these DME payments can be viewed as a substitute for the Part B charges that otherwise would be generated. The two options were:

1. Continue current DME payment policy, which pays teaching hospitals on the Part A side and make appropriate IME adjustments to the case payment.
2. Make all DME payments directly to the medical staff through the Part B side and make IME adjustments to the case payment as appropriate.

Other key parameters of the payment model included:

- Outliers. Outliers were identified using a method originally proposed by Keeler *et al.* (1988) and now employed by PPS for cost outliers. A fixed RVU amount "deductible" was added to each DRG rate to determine the outlier threshold for each DRG. Cases qualifying as outliers were reimbursed at a rate of 80 percent for services beyond the outlier threshold.
- Transfers. A graduated per-diem payment policy was incorporated to reflect the greater intensity of care at the beginning of the episode for medical cases. A transfer case in a sending hospital in a medical DRG would receive 150 percent of the per diem on the first day, 125 percent on day 2, and the straight per diem for all subsequent days. Transfer cases in surgical DRGs were paid the straight per diem for each day. Transfer payments were capped at the DRG case payment for nontransfer cases, but were subject to the same outlier policy as all other cases.
- Teaching Adjustment. Under payment models with the first DME payment option, case payments in teaching hospitals need to be adjusted downwards to offset DME Part A payments used to compensate residents for patient care services. Thus, medical staffs in teaching hospitals would receive a reduction in their case payment where the size of the reduction is determined by their resident-bed ratio. Under the second DME option, however, these staffs would receive a positive adjustment to their case payments. Incorporating DME into the Part B payments did not appear to fully compensate teaching staffs, hence the add-on.
- Disproportionate Share. There was no empirical evidence to support additional payments for staffs in DSH hospitals.
- Geographic Adjustments. The individual RVU components were adjusted by the appropriate Geographic Practice Cost Index (GPCI) to reflect variation in physician practice inputs (work, practice expense, and malpractice expense).

- Windows. Empirical data, and clinical experience, found little evidence to support an episode definition that extended much beyond the hospital stay itself. The pre-admission window was limited to the day prior to admission, and excluded physician visits in the office, patient's home, or nursing home. There was no window for the post-discharge period (with the exception of the global fee period for surgery, which remained unchanged from the MFS).

### Administrative and Legal Issues Associated with Implementation

Case study interviews were conducted at eleven hospitals in four cities: Atlanta, Boston, Chicago, and San Francisco. Interviewees included hospital managers, practicing physicians in virtually all specialties, managers of faculty and group practices, and IPA and PHO executives and board members. These interviews focused on hospital and physician receptivity to case payment, their ability to manage the risk involved, etc. In addition, we interviewed representatives of two Medicare carriers with regard to the data processing systems required under a new case payment program.

Key lessons learned include the following:

- Most physicians agreed that the PHO or similar entity was the most appropriate vehicle for receiving and distributing case payments. The medical staff per se does not have the legal standing to enter into and administer contractual relationships.

- PHOs and the like generally are not inclusive of the medical staff. They tend to be dominated by primary care physicians; even still, not all physicians admitting patients to a given hospital may be members of the PHO. This may pose problems if case payment requires participation by all members of the medical staff.

- A number of respondents expressed a preference for capitation over case payment. Concerns were raised about incentives for inappropriate admissions, early discharges, etc.

- Interviewees at several hospitals, including one currently participating in HCFA's Heart Bypass Demonstration, felt that an all-DRG model was considerably more difficult to implement than one limited to surgical DRGs.

- A new computerized administrative information system would be required to help PHOs monitor individual physician resource use, manage payment to individual physicians, and to administer various withholds and pooling arrangements.

- For demonstration purposes, an alternative claims payment system would also need to be developed. The manual methods being used under the Heart Bypass Demonstration would be unworkable under an all-DRG payment model.

Finally, a review of legal issues suggested two potential areas of concern: (1) "Stark II" fraud and abuse amendments; and (2) anti-trust. One solution would be for DHHS to consult with the Department of Justice and Federal Trade Commission with regard to establishing safe harbors for PHO physicians.

Redistributive Effects of Case Payment to Medical Staffs

We simulated the redistributive effects of four different payment models:

1. Physician services only, without direct medical education (DME);
2. Physician services only, with DME;
3. Combined facility and physician services, without DME; and
4. Combined facility and physician services, with DME.

Patterns of gains and losses were similar across all four models, although the absolute magnitude of gains (losses) were somewhat larger under models including DME payments. Furthermore, because PPS payments are assumed to be unchanged (i.e., no re-basing of PPS), gains and losses under a combined facility-physician payment system are driven solely by the redistribution of Part B dollars. Therefore, we limit our discussion of redistributive effects to those resulting from the first model: physician services only without DME.[2]

Case payment for inpatient physician services would result in considerable redistribution across medical staffs. Medical staffs in teaching hospitals (especially the COTH hospitals) and in large urban hospitals would lose money on average, while those in non-teaching and in rural hospitals would make money. Staffs practicing in the Mid-Atlantic region of the country would experience particularly large losses, while those in the West (particularly sparsely populated states) would enjoy windfall gains.

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[2] Chapter 6 of our report contains a complete presentation of all four models.

In order to better understand the factors contributing to gains (losses), we categorized all medical staffs into three groups:

1. Winners, defined as staffs who would receive at least 10 percent more per case under case payment than they did under fee-for-service. Over one-half of medical staffs (55.6%) met these criteria, but they accounted for only 24 percent of all admissions.

2. Losers, staff incurring losses of 10 percent or more. These included 10.7 percent of staffs, representing one-fifth (19.4%) of admissions.

3. Break-even staffs, i.e. all others. About one-third (33.7%) of staffs fell into this category, but they accounted for over one-half (56.5%) of all admissions.

DRG-level analyses revealed clear patterns for all groups: Medical DRGs are the most important contributor to gains and losses. While losing medical staffs would experience losses on all DRGs, they would lose relatively more on the medical cases. These higher losses are compounded by the higher volumes of medical DRGs. Similarly, while winning medical staffs would make money on all of their DRGs, the gains are relatively greater for the medical DRGs. How does the middle category of medical staffs manage to break even? By offsetting losses on medical DRGs with gains on surgical DRGs.

What are losing medical staffs doing to their patients to occasion these losses? They keep their patients in the hospital longer and provide more services while they are there, compared with other staffs. More hospital visits and more consultations account for most of the differential in service intensity (as measured by RVUs).

Policy Implications

The simulations and other analyses we conducted raise important issues for the implementation of a national per case payment policy. These issues can be grouped into the following categories:

1. Redistributive effects - how to minimize the large losses and windfall gains that many medical staffs would experience;

2. Role of direct medical education costs - whether these should be in or out of the payment system;

3. Outlier policy - how to identify and reimburse outlier cases;

4. Transition options - how to move medical staffs toward a national payment system; and

5. Exempt staffs - whether some medical staffs should be excluded from a national system.

We discuss each of these in turn below.

Redistributive Effects

The introduction of any new payment system will result in winners and losers. Under the PSO model without DME, about one-fifth of medical staffs (weighted) would experience losses of 10 percent or more, compared to current fee-for-service billings, while about one-quarter of staffs would enjoy windfall gains of at least 10 percent. Part B dollars would be allocated away from staffs in teaching and large urban hospitals and toward staffs in non-teaching and in rural hospitals.

The magnitude of this redistribution could be altered by changing various parameters of the payment model. Examples include the following:

- Calculate separate standardized payment amounts for staffs in urban and rural hospitals. This would greatly attenuate the urban-rural redistribution.
- Calculate separate standardized payment amounts by region or census division. This would "protect" high cost states, like New Jersey, New York, and Pennsylvania, while reducing windfalls to more rural Western states, like Idaho, Montana, Oregon, Utah, and Wyoming.
- Expand the size of the outlier pool. This would lower the outlier threshold, and shift some payments back to teaching hospitals.

These options are based on the premise that the payment models have somehow failed to adequately capture some important distinctions of medical staffs, and that special adjustments are therefore necessary to avoid over (under) paying them. An alternative explanation, however, is that these staff characteristics are associated with more (less) efficient styles of practice. If so, then policymakers would not want to penalize frugal staffs in Oregon, for example, while rewarding high-volume staffs in New Jersey.

We believe that a national per case payment system should be based on a single standardized payment amount. In order to minimize the dislocations that would accompany this, we recommend that HCFA consider a transition to a national standardized payment amount. Transition could be based on a blend of regional (and/or urban-rural) and federal payment amounts; we discuss transition in more detail below.

## Direct Medical Education Costs

Including direct medical education (DME) costs in the case payments would result in somewhat larger losses for teaching medical staffs. Academic medical center staffs would experience losses of 11.5 percent on average, for example, compared with 7.7 percent when DME is not included. In part, we suspect this may be due to some measurement error in our calculation of the costs of residents' services. We allocated all DME payments to the case payment, but residents also provide services in hospital OPDs. No data were available on where residents worked, and we may have overstated the amount of DME payments associated with inpatient care. Furthermore, the actual methodology used by Medicare to calculate hospital-specific DME payments is not based on the actual cost of resident services.

Both the Administration and Congress are actively considering alternative approaches to determining Medicare's share of direct medical education costs. Given these imminent changes, we recommend that DME costs not be included in per case payment at this time.

## Outlier Policy

Simulations found that gains (losses) were very sensitive to the relative number of outliers treated by medical staffs. The larger the relative number of outliers, the greater would be the loss incurred by the medical staff. Their comparatively greater number of outliers may be one of the reasons that staffs in teaching hospitals would lose money under case payment. Furthermore, a staff's outlier share is a far more important predictor of gains and losses (in terms of its average dollar impact) than is teaching intensity.

There are two sources of potential loss associated with outlier cases in our simulations: (1) the difference between the mean DRG payment and the mean outlier threshold; and (2) the less than 100 percent reimbursement of amounts above the threshold (80%, in our simulations). The former is by far a more important source of loss. By expanding the outlier pool and lowering the outlier threshold, HCFA could reduce the losses associated with outlier cases. To the extent that high cost cases reflect inappropriately high service use, however, such a policy could inadvertently reward inefficient practice.

Under a combined facility-physician payment system, however, only a single definition of outliers should be used. Two definitions would be needlessly cumbersome and could dilute some of the cost control incentives inherent in case payment. One solution would be to define outliers based on the PPS outlier methodology, i.e., current PPS outliers would also be outliers under per case FPS payment. Since hospitals and physicians are complementary inputs in the production of inpatient care, such an approach would reinforce the incentives introduced by combining PPS and Part B payment in the first place. HCFA need simply add the per case physician component of the outlier payment to that already being calculated under PPS.

## Transition Options

HCFA has traditionally included a transition period for any new reimbursement change, typically four to five years. Such a transition can help to minimize the financial dislocation resulting from the payment change and to give providers time to make the necessary practice adjustments; for this reason, it is also (practically speaking) a political necessity. Typically, transition takes the form of blended payments. We believe there are two types of blended payment that HCFA should consider:

1. medical staff historical payments blended with national standardized payment amounts; and

2. area-specific payments blended with national amounts.

The first option provides the least dislocation, as medical staffs would receive case payments that are based, in part, on what they customarily received for similar patients. Depending on the areas chosen, the second option can provide varying amounts of protection for medical staff. During PPS transition, for example, a total of 18 areas (9 census divisions * urban/rural) were used. Even greater protection could be afforded through smaller geographic units, e.g., GPCI payment localities.

It should be noted that while staff-specific blended payments (and/or a longer transition period) will protect some medical staffs from sudden revenue reductions, they also will prevent other staffs from achieving immediate gains in revenue. These latter staffs may press for a full transition in year one. At the beginning of PPS, for example, Oregon hospitals successfully lobbied to skip over transition entirely.

## Exempt Medical Staffs

Under a national policy, per case payment should apply to all medical staffs at PPS hospitals. There is no conceptual reason why medical staffs in hospitals receiving PPS case payments should not receive similar payments for Part B services. Nor did the simulations suggest that any category of medical staff (e.g., those in small rural hospitals) should be exempt because of random variation due small numbers of admissions. Medical staffs at PPS-exempt hospitals (psychiatric, long-term care, rehabilitation, and children's hospitals) and admissions in exempt units (psychiatric and rehabilitation) should be excluded from per case payment. Inpatient physician services in these units and hospitals might be bundled for case payment in the future, but such a policy should be considered in conjunction with how these hospitals are reimbursed under Part A.

Future Work

Implementing a national per case payment system poses many challenges for HCFA. Physicians would need to organize into groups legally and administratively capable of receiving and disbursing the case payments. New information systems would need to be developed for internal management and utilization review and for claims payment. Safe harbors would need to be created to protect physicians from anti-trust and Stark II litigation. These are but a few of the many issues that will need to be addressed. For these reasons, HCFA has elected to first test a combined facility-physician payment methodology on a demonstration basis. Beginning in October 1997, medical staffs in four to six demonstration sites will begin to be paid a fixed DRG amount per case. This demonstration will provide HCFA with an opportunity to assess the feasibility of per case payment for inpatient physician services.

## 1.3 Overview of Report

Chapter 2 provides an overview of the basic case payment models and an analytic framework for evaluating physician responses to case payment. Data sources and methods for variable construction (including DME RVUs) are described in Chapter 3. Chapter 4 provides a detailed description of how all of the payment parameters were developed, the rationale for their use, and how the weights, standardized amounts, etc. were actually calculated. A detailed discussion of administrative implementation issues is presented in Chapter 5, including case study results and legal analysis. Finally, Chapter 6 presents simulation results, followed by a discussion of transition options and policy implications.

# 2.0 CASE PAYMENT MODELS AND PHYSICIAN RESPONSES

## 2.1 Case Payment Models

We develop two basic payment models that bundle individual physician services into a single unit for each inpatient case by DRG. These models were developed using principles from Medicare's fee schedule and Prospective Payment System. The first model is a physician-services only (PSO) model which combines all physician Part B services for an inpatient episode of care into a single payment. The second is a facility-physician service (FPS) model which combines payment for all Part B physician services for an inpatient episode of care by DRG with the hospital's corresponding PPS payment. An integrated FPS model that fully combines Part A and B payments for episodes of care should, in theory, create stronger incentives to provide efficient, cost-effective care.

Researchers have found that Part B charges or billing by teaching hospital medical staffs are lower, on average, than nonteaching medical staffs (Mitchell *et al.* 1994; Miller and Welch, 1993). This is due to residents substituting for teaching physicians (and residents cannot submit Part B bills for their Medicare services). Thus, excluding the implicit volume of resident-provided services will under-count the total volume of services provided by teaching medical staffs. However, compensation for resident services and teaching by physicians is made through the Part A hospital DME payments. We explicitly address the issue of resident-provided inpatient services in our physician payment models, as discussed below.

The basic PSO and FPS payment models were developed under two policy options for paying DME costs; thus, there are two parallel models for both our PSO and FPS models, with the same design elements within the respective PSO and FPS models.[1] That is, we developed the PSO and FPS models separately under two distinct DME policy options, yielding four payment models. These DME policy options are:

- **Policy option 1:** Continue current DME payment policy, which pays teaching hospitals on the Part A side, and make appropriate IME adjustments to the bundled physician payments.
- **Policy option 2:** Make all DME payments to the medical staff through the Part B side and make IME adjustments to the bundled physician payments as appropriate.

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[1] The key difference between the two models is the treatment of resident-provided services, which leads to different mean RVUs per DRG. This results in differences between the two in terms of sample size (due to different trims), standardized RVU amounts, DRG RVU weights, CMIs, outlier thresholds, CFs, payment levels, and distributional impacts.

The current DME payment policy was designed to support the training of physicians (and other allied health professionals), which implicitly includes physician services provided by residents. To this end, DME payments are intended to cover the salaries and benefits of residents and teaching physicians, plus related residency program administrative and overhead expenses. A base year per-resident amount is determined through accounting cost finding principles and then updated annually by the urban consumer price index. A teaching hospital's Medicare DME payments equal the hospital's per-resident amount multiplied by the number of full time equivalent (FTE) residents[2], multiplied by the hospital's Medicare share of total days.

Under the first policy option DME payments would continue to be made on a per resident basis to teaching hospitals on the Part A side. The medical staff would not receive DME payments directly nor would the implicit value of services (in terms of RVUs) provided by residents be incorporated into the DRG episode RVU amounts and payment weights (we describe our method for imputing resident service RVUs, or DME RVUs, in Chapter 3 below). That is, the current DME policy would not change and no adjustments would be made to the PSO and FPS models' standardized RVU amounts or DRG RVU weights.

Under the second policy option, DME payments would no longer be made to teaching hospitals through Part A. The basic idea behind this policy option is to separate salaries and benefits of interns and residents and teaching physician salaries from the Part A DME payment--leaving Part A DME as a facility overhead payment--and have medical staffs compensate interns and residents.[3] DME payments for compensating interns and residents would flow through the medical staff payments through the Part B side in both PSO and FPS models by incorporating the value of resident-provided physician services into the standardized RVU amounts and DRG RVU weights.

The standardized RVU amounts, which are applied to all cases at teaching and nonteaching hospitals, reflect the extra value of services provided by residents. That is, by incorporating DME RVUs into the basic measure of physician RVUs, the unstandardized RVU amounts are increased for any medical staff, not just for teaching medical staffs.[4] However, teaching hospitals benefit directly, to a greater extent, by the inclusion of DME RVUs because DRG RVU payment weights will increase for those DRGs that are disproportionately provided in teaching hospitals.

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[2] An individual resident receives a weight of 1.0 if he/she is (a) in the initial residency period, (b) serves the number of hours necessary to fill a full-time residency slot, and (c) is a U.S. medical graduate or a foreign medical graduate (FMG) who fulfills the necessary requirements before their residency begins. If a resident rotates across multiple hospitals, then the weight is prorated so that it does not exceed 1.0. Residents beyond initial residency receive a weight of 0.5 while FMGs not meeting the appropriate criteria for a residency receive a weight of zero.

[3] Our method essentially reduces Part A teaching hospital DME payments by lowering or removing the per-resident amount, though IME payments to teaching hospitals need not be reduced. However, HCFA may need to consider offsetting physician IME payments by reducing teaching hospital IME payments to preserve budget neutrality. We did not pursue rebasing Part A IME payments.

In theory, paying for residents through physician service payments will create a competitive environment for residents among medical staffs. Resident salaries would be determined in a competitive fashion based on the expected marginal revenue product of the resident. Such a policy could even reinforce efforts to raise the number of primary care physicians. That is, because the Medicare RBRVS forms the basis of our per-case payments, and the relative values of primary care and evaluation and management (E&M) services were increased vis-a-vis invasive procedures under RBRVS, residents in primary care residencies would be expected to have relatively higher marginal revenue products--at least for those DRGs with greater proportions of E&M and primary care services (due to their relatively higher prices).

## 2.2 Physician Incentives under Case Payment

### 2.2.1 Physician Behavioral Responses

The major objective of the PSO and FPS models is to improve the efficiency by which Medicare inpatient physician and hospital services are produced. Our models attempt to bundle payment around specific, identifiable episodes of care and to make aggregate payment less dependent on the number of providers and individual services. Improved efficiency should reduce the rate of growth in total Medicare expenditures for physician and hospital services compared to the current fee-for-service system. Bundled payments in the PSO model would be made to the medical staff which would then be responsible for making the final payments to individual physicians.[5] This model contrasts with the current fee-for-service model by placing greater risk onto the medical staff. That is, the medical staff is predicted to have strong incentives to curtail unneeded or marginally necessary physician services when subject to a bundled payment per DRG. Possible behavioral responses could include earlier discharges, more post-discharge care (and less inpatient care), shorter ICU stays, shorter times in the operating room, substitution of labor inputs (e.g., registered nurses for physicians), shifting of care from inpatient facilities to outpatient settings, and fewer diagnostic tests. Under the FPS model, payment for each DRG would be made to a joint hospital-staff entity, such as a physician-hospital organization (PHO), which would then decide how to distribute the single payment per DRG. Efficiency gains are anticipated under the FPS model because of the integration of incentives between the hospital and medical staff to utilize resources more economically. For example, physicians may begin to substitute generic drugs for more expensive name brand drugs to limit costs.

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[4] Due to standardization by expected IME payments (in the form of the IME percentage of teaching hospitals), the standardized RVU amount is reduced.

[5] In fact, case payments actually would be made to a physician-hospital organization (PHO) or similar entity representing the medical staff. As discussed in Chapter 5, PHOs typically represent most, but not all, attending physicians, a fact which may complicate implementation. For convenience here, however, we refer to the "medical staff."

General predictions from the PSO and FPS models are based on the theory of profit/utility maximization. That is, our predictions of the outcomes from these models are predicated on the assumption that physicians and hospitals prefer higher net incomes or revenue and will behave in a manner to reach their objectives. Under the general profit maximization model, providers produce services up to the point where marginal revenue is equal to marginal cost. Under the PSO and FPS models, a fixed payment per episode of care gives providers an incentive to manage the case to incur costs at or below the reimbursement by curtailing marginally useful or unnecessary services, if each individual provider is put at risk.

In terms of expenditures, HCFA is at risk only for increased admissions, not individual service volumes or intensity, since HCFA's risk exposure is based on the admission. However, "gaming" in the form of selection, for example, where easy cases are directed to medical staffs subject to bundled case payment while difficult cases are treated in the FFS environment, could increase HCFA total payments (we discuss perverse effects from our models below).

### 2.2.2 Predicting Relative Strengths of Incentives

The actual strength of the incentives under the case payment models will depend on the following key dimensions:

1. method of payment;
2. nature of risks/rewards;
3. size and nature of risk pool;
4. practice style; and
5. share of total patient revenue subject to the case payment system.

Method of payment to physicians in the medical staff can enhance or weaken the fundamental incentives presented by the case payment models. If physicians in the medical staff are salaried, for example, providing additional services will not lead to higher incomes. Under the PSO model, behavior may not be greatly altered for salaried physicians, especially physicians belonging to an academic faculty practice plan. The FPS model integrates the hospital and medical staff payments, in theory, leading to tighter alignment of incentives. Therefore, salaried physicians, who are not directly responsible for ancillary hospital inputs under the PSO model, may now have an incentive to alter their use of hospital inputs. If physicians on the medical staff are paid under fee-for-service (FFS) , responding to incentives under the PSO and FPS models represents a more significant change in physician behavior. Under FFS, physicians generally have a stronger incentive to provide more services (at least up to the point where the marginal revenue of doing so is equal to the marginal [private] cost), and do not have strong economic incentives to limit their use of ancillary physician or hospital inputs. Under the case payment models, physicians would likely be penalized for excessive utilization.

The risk and reward structure within the financial arrangement between individuals and the economic entity will have an important influence on the strength of providers' responses to the case payment models. Specifically, the extent to which individual providers are put at risk for volume and intensity of care creates, perhaps, the strongest incentive to limit provision of services. For example, if payment to the admitting physician can be reduced by consults given by other physicians, then the admitting physician has a strong incentive to limit the number of consults.

The risk and reward structure is closely dependent upon the size of the risk pool. That is, which physicians are included when determining the relevant services and expenses associated with the inpatient episode? Are all physicians providing services to patients at the hospital included? Are non-staff physicians to be included? If a PHO is the basic economic entity, how will services provided by non-PHO physicians be assessed? In general, the more physicians involved in the risk pool, the more difficult it becomes to control volume and intensity of care because each N-th physician would be sharing at a rate of 1/N in the payment and costs (Gaynor and Pauly, 1990). The administrative burden associated with a case payment system also increases as the number of providers increases. *Ceteris paribus*, the smaller the number of physicians, the easier it is to monitor behavior and effect changes in practice styles. Under the combined payment FPS model, risks and rewards might be based on both hospital and physician performance.

Practice style is another factor that can influence the effectiveness of incentives under the PSO and FPS models. Multi-specialty group practice HMOs, for instance, already are subject to strong incentives to control excess volume and utilization. A bundled payment system would not cause radical changes in behavior as the group would be accustomed to close utilization monitoring and incentives to be more efficient. To the extent that a PHO is involved in managed care arrangements, member physicians may be practicing under the influence of managed care incentives and will be able to respond to incentives under the case payment models by employing an efficient practice style.

Finally, if the Medicare share of total patients is low then practice patterns may not be altered greatly. The rewards from modifying practice behavior are likely to be proportionate to the amount of revenue generated through the case payment system. A priori, we expect that physicians in hospitals with high Medicare caseloads would benefit more from adjusting their practice patterns under the case payment models.

### 2.2.3 Perverse Effects

The positive incentives contained within the PSO and FPS models may not result in behavior modification which leads to an optimal outcome because of potential perverse effects. As discussed above, one possible mal-incentive by medical staffs would be to select less costly cases for treatment under the case payment system, and to direct cases anticipated to be more costly to a FFS setting (e.g., outpatient facilities, hospitals not subject to case payment, etc.). Hospitals may also attempt to transfer high-cost cases even faster . These types of selection bias would increase profit and revenue--and increase total Medicare expenditures--as below-average-cost cases would receive an average payment while above-average-cost cases would generate greater revenue from higher service utilization.

Another way to game the system is to keep patients in the hospital longer and receive an extra outlier payment. Under the PSO model, the medical staff may attempt to stretch patient stays to generate higher outlier payments even if the hospital does not qualify for outlier payments for its operating costs. This incentive may be weaker under the FPS model since the hospital and medical staff would be functioning with aligned economic incentives.

The bundled payment models provide incentives to limit unnecessary and marginally useful services. However, the exact threshold where service reduction is inappropriate is unknown. Some providers may reduce services or "skimp" on care to the detriment of patients. The exact likelihood of quality reduction depends on the specific nature of incentives facing individual physicians and the significance of offsetting factors that discourage bad medicine. Also, Medicare beneficiaries may perceive a drop in quality if nonphysicians substitute for physicians, if hospital lengths of stay are reduced, or if they are transferred to other facilities. Access to care could also be jeopardized under the case payment models, particularly for those cases with expected higher costs. If a patient can be identified as a high cost patient prior to admission, admitting physicians might be tempted to admit the patient to a hospital not subject to bundled payments or refer the patient to a physician elsewhere.

# 3.0 DATA AND METHODS

## 3.1 Data Sources

Our payment models were developed using a new episode of care data base, the 1992 Episode Data Base, created by HCFA from 1992 National Claims History (NCH) data. The Episode Data Base includes 100 percent Part A and Part B claims for all hospitalizations occurring within the five month period, February 1 - June 30, 1992, and represents five of the first six month's experience under the Medicare physician fee schedule. An extensive comparison of the Part A claims from this data base and the universe of calendar year 1992 Part A claims failed to find any significant seasonal differences in casemix or disease severity.

The Episode Data Base uses MedPAR records as the principal source of identifying an episode of care. Noninpatient bills and claims were identified as being related to an admission if the service occurred within the window of 30 days prior to the admission and 90 days after the date of discharge. Summary lines are attached to each MedPAR record and to each Part B line item and noninpatient Part A bill, thereby allowing linking of physician services to inpatient admissions. The result is an episode file which contains over 3.7 million inpatient episodes.

Our principal analytic file includes physician service line-item detail for each inpatient admission in nonfederal, acute-care, short-stay hospitals in the U.S. Therefore we removed episodes in which the inclusion in our data base was predicated on admission to a hospital with one of the following characteristics:

- HCFA Demonstration dummy IDs;
- Federal[1] and military hospitals;
- Exempt hospitals and units, skilled nursing facilities, etc.; or
- Hospitals located in Puerto Rico, Virgin Islands, Africa, Canada, Central America & West Indies, Europe, Mexico, Oceania, Philippines, South America, U.S. Possessions, American Samoa, Guam, Saipan, or Northern Marianas.

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[1] For 1992 admissions under 1992 hospital classifications.

To ensure that we have data that are representative of a Medicare beneficiary's full utilization, we have excluded certain types of beneficiaries from our Episode Data Base. Most notably, we have removed all beneficiaries without both Part A and Part B entitlement for the full episode period, as well as those beneficiaries with membership in an HMO for any time during the full episode period.

### 3.2 Relative Value Units (RVUs) and RVU-Equivalents

Because 1992 was the first year of transition under the Medicare Fee Schedule, allowed charges represent payments that are largely based on historical reimbursement amount and only partially on resource costs. For this reason, we used relative value units rather than payments for all work conducted developing the payment models. RVUs were then converted to Part B dollars for simulation purposes (see Chapter 5 for more detail).

Total relative value units for 1993 (by the work, practice, and malpractice expense components) were merged onto all services found in the Medicare Fee Schedule. Services provided by physicians but not reimbursed under the MFS do not have RVUs. Generally, these services are anesthesia services and physician services that are locally priced by Medicare carriers or under other payment methodologies.

For nonanesthesia services without RVUs, we created 1993 RVU equivalents as follows:

1. We merged on the appropriate locality-specific geographic adjustment factors (GAFs) to the claims data at the Medicare payment locality level.

2. The allowed charge was divided by the GAF to yield an allowed charge adjusted for differences in geographic input costs; i.e., we create "GPCI-ed" allowed charges.

3. The "GPCI-ed" allowed charges were aggregated across all payment localities and the sum was divided by total frequency for each procedure code/modifier combination to yield 1992 "GPCI-ed" average allowed charges.

4. We divided "GPCI-ed" average allowed charges by the 1992 CF of $31.001 to create 1992 RVU equivalents.

5. Finally, we applied Medicare's across the board budget-neutrality adjustment by multiplying the 1992 RVUs by 0.97217 to yield 1993 RVU equivalents.

RVU equivalents for anesthesia services were created using the following steps:

1. Anesthesia services were selected using a combination of procedure code, type of service and provider type.

2. Three separate data sets were created based upon the type of provider of the anesthesia service: physician anesthesiologist, nonmedically directed CRNA, and medically directed CRNA.

3. The appropriate provider type- and locality-specific CFs were merged onto the claims data at the Medicare payment locality level in each of the three data sets. If the CRNA's CF was higher than the participating (PAR) physician CF, we substituted the PAR physician CF for the CRNA CF.

4. The allowed charge was divided by the CF that had been merged onto the line-item to yield an estimate of the sum of the base and time units. This step removed the effects of the transition on the allowed charge and the geographic adjustment made to the base and time units.

5. The sum of the base and time units was multiplied by the 1992 provider type-specific CF: $13.94 for physicians; $13.94 for nonmedically directed CRNAs and $10.75 for medically directed CRNAs.

6. The adjusted allowed charge was divided by $31.001 to create 1992 RVU equivalents for anesthesia services.

7. The 1992 RVU equivalents were multiplied by 0.97217 to yield 1993 RVU equivalents for anesthesia services, which are on the same scale as all other physician services.

### 3.3 Calculation of Direct Medical Education (DME) RVUs

We measure the implicit value of physician services provided by residents (but not billed for) for a case in a given DRG within a given hospital (i.e., DMERVUs) by first taking the Part A DME payments to the hospital and adjusting them for factor price differences across regions using the hospital's HCFA wage index (WI) for the labor share of costs and cost of living adjustment (COLA) for the nonlabor cost share. The adjusted DME payments are then divided by the national conversion factor in 1992 ($31.001) to create total DMERVUs for the hospital. DMERVUs are then allocated to each individual case within the hospital by the case's share of total Medicare days in the hospital. The DMERVU equation is:

$$DMERVUs_{i;d,h} = \frac{(Part\ A\ DME\ payments_h)}{[WI * labor\ share + COLA * nonlabor\ share]_h * CF} * \frac{LOS_{i;d,h}}{\sum_{d=1}^{494}\sum_{i=1}^{n} LOS_{i;d,h}} \qquad (1)$$

where DMERVUs$_{i,h,d}$ represents the number of RVUs provided by residents in the medical staff at hospital h for the i-th patient in DRG d; Part A DME payments$_h$ are the total 1992 DME payments to hospital h;[2] WI is the PPS Wage Index; COLA is the cost-of-living adjustment for nonlabor inputs; and LOS$_{i;d,h}$ is the length of stay or number of inpatient Medicare days for the i-th patient in the d-th DRG in hospital h. Thus, the first ratio on the right hand side of the equation provides an approximation of the total RVUs for services provided by residents at hospital h. The hospital or medical staff total DMERVU is allocated to each individual patient by the share of Medicare days in hospital h at the admission level. Thus, individual admissions receive DMERVUs according to their length of stay--admissions with longer lengths of stay are allocated more DMERVUs than those with shorter lengths of stay. We chose to allocate aggregate hospital DMERVUs by LOS after examining two allocation methods. The first was by share of total hospital RVUs while the second was by LOS. The RVU share allocation method was found to be highly variable because some discharges had few or no reported services and accompanying RVUs, possibly due to residents substituting for physicians. Allocation of DMERVUs by LOS was found to be more stable and plausible. The use of LOS suggests that a hospital day is a reasonable proxy for physician service intensity and that resident service provision is correlated with physician service intensity and LOS.

Our calculation of DMERVUs differs from the method used by Miller and Welch (1993) which calculates a national average number of RVUs per resident, adjusts this value by the hospital's casemix index, and then multiplies through by the ratio of residents to admissions in the hospital. That is, the Miller and Welch (1993) method calculates hospital level resident RVUs from national averages instead of hospital specific values, thus their RVUs per resident are not fully hospital-specific. In contrast, our method relies exclusively on hospital-specific information (e.g., hospital DME payments; patient LOS within hospital).

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[2] We obtained annual hospital DME payments from 1991 (PPS-8) and 1990 (PPS-7) Medicare cost reports. All DME payments were "aged" to 1992 using relevant PPS update factors. Also, we multiplied DME amounts by 0.42 to be consistent with 5 months of 1992 Medicare admissions in the Medicare Episode Data Base.

### 3.4 Hospital-Level Variables

Other data were merged onto admission records as needed from the following data bases: Hospital Medicare Cost Report information from the Hospital Cost Reporting Information System, Minimum Data Sets for 1990 and 1991; other hospital information from the 1995 Medicare Impact file; and fully phased-in 1995 GPCIs from HCFA. Because we developed our physician payment models under 1995 conditions (e.g., hospital control, region, urban status in 1995), totals for some hospital strata shown in Chapters 4 and 6 do not reconcile with overall table totals due to missing information.

## 4.0 PAYMENT DESIGN AND DEVELOPMENT

The primary objective of this project was to develop alternative payment systems for inpatient physician services to the traditional fee-for-service system. Our models for the payment systems combine elements from Medicare's prospective payment system (PPS) for Part A inpatient services and from the Medicare fee schedule (MFS), which is based on the resource-based relative value scale (RBRVS), for Part B physician services. Important decisions for all key design issues in the payment system involved input from physicians, a technical advisory panel (consisting of physicians and health services researchers), and personnel from the Health Care Financing Administration (HCFA).

In Section 4.1 we discuss the various design issues associated with the development of our physician payment models. Section 4.2 includes a detailed description of our methodology for developing the physician payment systems.

### 4.1 Design Issues

Several important design issues were analyzed during the development phase of the physician payment models. The key design issues included defining the length of the service window, treatment of low-volume DRGs, payment for outlier cases, payment for transfer cases, teaching adjustments, disproportionate share adjustments, and geographic payment adjustments. We discuss each in turn below.

### 4.1.1 Payment Windows

Under a per case prospective payment system, physicians will have an incentive to shift services outside the inpatient stay. For this reason, it may make sense to define the episode to include some amount of pre-admission and post-discharge care. These time intervals surrounding the hospitalization are often referred to as "windows." We examined two issues in particular:

1. What is the appropriate length of the window, both pre-admission and post-discharge? Should the window duration vary by DRG? HCFA wants to maintain the 90-day surgical global policy which is an integral part of the MFS, while imposing alternative windows around the episode. Thus, the 90-day policy would remain in effect for services provided by the surgeon, while a different time frame might be defined for inpatient services provided by all other physicians.

2. Which services should be included in the window? Only evaluation and management services, for example, or all types of services?

The Episode Data Base included all physician services provided during the 30-day period preceding admission and for 90 days following discharge. These long time periods enable us to evaluate a wide range of alternative window definitions. The distributions of average daily RVUs were examined for both time periods. Relatively little physician activity was found in either window. The majority of pre-admission activity occurred on the day prior to admission, approximately 1.5 RVUs compared with 36 for the hospitalization itself. There was even less activity during the post-discharge period, with physician services dropping off markedly within a week following discharge. These patterns were consistent across major diagnostic categories and across hospitals with varying characteristics.

We then examined the specific types of services being provided during these windows and whether they varied by DRG. Particular consideration was given to the following factors:

- The amount of services that might be delivered immediately prior to admission and that were related to the reason for admission.
- The location of these services, e.g., office, emergency room, etc.
- The type of service provided, i.e., evaluation and management, procedures, imaging, and other tests.

Patterns of treatment by DRG were carefully reviewed by a team of three clinicians: an internist, a family practitioner, and an orthopedic surgeon.

Based on review of the empirical data and clinical experience, we drew the following conclusions with regard to the pre-admission window:

1. Only a one day pre-admission should be considered. There is a consistent increase in RVUs on the day prior to admission. This suggests that patients who are ill enough to require hospitalization have an "event" which causes a rapid decline in health during the 24 hours prior to admission. We found no rationale, either from the data or clinical experience, for a longer pre-admit window such as three days.

2. The window should not vary by DRG. There was little variation in RVU patterns across DRGs or across types of DRGs, such as hematology/oncology DRGs vs. surgical DRGs vs. medical DRGs such as pneumonia or CHF.

3. The pre-admission window should include all services except office visits, home visits, and nursing home visits. We found no increase in RVUs for these services in the pre-admission period. This is consistent with our clinical experience that most hospitalizations are the result of a fairly acute event that results in a rapid decline in health that demands more intensive services than can be provided in these settings. We believe that exempting these services would encourage physicians to provide out-of-hospital services in an effort to avoid hospitalization.

For the post-discharge window, we drew the following conclusions:

4. We were unable to identify any group or type of DRG that clearly lends itself to a post-discharge window. There is little activity in the post-discharge period up to one week, at which time most services begin to return to the baseline RVU activity level found two weeks prior to admission.
5. For the hematology/oncology DRGs, radiation therapy did demonstrate a clear increase in RVUs in the two weeks after discharge. However, this service is also higher in the pre-admission period and we were unable to attribute radiation therapy to a specific admission.

At this time, there is no evidence to support a post-discharge window. Nevertheless, some such window might be required in the future in order to prevent early discharge and shifting of services to the outpatient setting. In the event this should prove necessary, project clinicians believed this window should be relatively short, e.g., 3-4 days. It would also be important to provide an opportunity to bill for an unrelated condition or illness that might arise during this post-discharge window.

### 4.1.2 Low-Volume DRGs

During the development of the Medicare PPS, 119 DRGs were found to have insufficient annual Medicare volume to construct valid cost weights. We were alert to the possibility of "low-volume" DRGs and conducted statistical tests. Specifically, after we constructed preliminary RVU means for each DRG, we calculated the minimum sample size necessary for statistical validity for each DRG as:

$$Minimum\ sample_d = (16.5 * (S_d / \bar{x}))^2 \qquad (2)$$

where minimum sample $_d$ is the minimum sample size in terms of discharges for DRG d; 16.5 is the Z-value from a 90 percent confidence interval (1.65) divided by the arbitrary 0.10 sample allowance, or 1.65/0.10 = 16.5; $S_d$ = standard deviation of RVUs for each DRG; and x-bar is the mean of RVUs for each DRG.

A total of 62 different DRGs in our file were determined to be low volume DRGs according to statistical sampling criteria. For those low volume DRGs, we imputed their RVU weights by using coefficients from a regression model to create predicted RVU weight values (see Table 4-1). The DRG level regression model used the natural log of the number of RVUs per discharge for the DRG, normalized to the mean over all DRGs, as the dependent variable and included the DRG's Medicare DRG weight (also normalized to the mean over all DRGs), a dummy variable for surgical DRGs, and an interaction term between the surgical DRG dummy variable and the DRG weight. (Only high volume DRGs were included in the regression.) The regression model produced an R-square of 0.91.

Physician members of our project team carefully reviewed all imputed weights for low-volume DRGs and determined all but 12 (out of 62) to be acceptable. Based on clinical input, we decided to drop 13 DRGs (12 low volume DRGs, plus DRG 470). Specifically, we excluded the following DRGs from our prospective physician payment system: 481, 059, 061, 062, 163, 291, 342, 372, 378, 385, 389, 390, and 470. The total number of records in these 13 DRGs equals 594.

### 4.1.3 Outlier Cases

Payment for outlier cases was another significant issue we analyzed during development of the models. We incorporate in our models an outlier policy originally proposed by Keeler *et al.* (1988), and now employed by HCFA for PPS cost outliers. Keeler *et al.* (1988) have shown that provider risk is minimized if the threshold for cost outliers is set such that the loss incurred before outlier payments begin is the same for every DRG. This fixed dollar amount "deductible" is added to each DRG rate to determine the outlier threshold for each DRG.[1] Cases qualifying as outliers receive additional payment to the case payment. The deductible is determined by the size of the outlier pool. In addition, outlier payments are not funded through a uniform percentage reduction, but rather the contribution of each DRG to the outlier pool reflects its anticipated percentage of outliers.[2] That is, DRG-specific outlier

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[1] In the PSO model, Part B outlier status and reimbursement will be determined by RVUs multiplied by the national conversion factor, not physician charges.

[2] At the second TAP meeting, we learned from HCFA officials that differential outlier contributions were not being applied under PPS; Rather each DRG is making an equal contribution. An iterative process is required to obtain unique solutions. In our model, we assume that convergence occurs rapidly, thus we utilize a recursive model to resolve circularity conflicts inherent with this problem.

TABLE 4-1

## REGRESSION RESULTS USED TO IMPUTE DRG RVU WEIGHTS FOR LOW-VOLUME DRGs (a)

| Variable | Coefficient | t-statistic |
|---|---|---|
| Intercept | 0.2025 | 4.39 |
| Normalized DRG weight (b) | 0.5208 | 8.19 |
| Surgical DRG dummy | 0.4430 | 8.10 |
| Surgical DRG dummy * DRG Weight (c) | 0.1500 | 2.31 |
| | | |
| Number of DRGs | 403 | |
| Adjusted R-square | 0.91 | |

**NOTES:**

Dependent variable is the natural log of RVUs/discharge per DRG, normalized to the mean over all DRGs.

(a) Only high-volume DRGs were used in the regression.
(b) Normalized to the mean weight over all DRGs.
(c) Interaction term between Surgical DRG dummy and DRG weight.

SOURCE: HER analysis of 1992 Episode Data Base.

contributions are proportional to expected outlier payments. Thus, DRGs with greater expected outlier payments contribute more to the outlier pool than DRGs with fewer expected outlier payments. Under this approach, hospitals/medical staffs that specialize in certain DRGs would not gain or lose from outlier payments.

Our outlier policy is based on an expected outlier payout of five percent of the total RVUs (or dollars). The second issue to consider is the amount reimbursed above the outlier threshold. Provider risk is minimized if all services above the outlier threshold are reimbursed in full. However, we believe that maintaining some incentive for cost control even in catastrophic cases is important. Moreover, the marginal costs of care may be much less than the full payment rate.[3] PPS outlier policy has reimbursed at less than the full rate above the outlier threshold on the theory that marginal costs are lower than average costs--current PPS cost outliers are paid at 80 percent above the threshold.

All RVUs going into the basic payment need to be reduced by some fraction to maintain budget neutrality. Unlike previous PPS cost outlier policies that imposed a uniform reduction to the national standardized amount, under our fixed-loss cost outlier policy we impose DRG-specific contributions to the outlier pool. That is, those DRGs expected to receive greater outlier payments contribute proportionately more to the outlier pool than DRGs with fewer anticipated outlier payments. This contribution--because it is DRG specific--is not imposed via a reduction in the standardized amount alone. Rather, the DRG-specific outlier contribution occurs through reductions to the adjusted RVUs per case within DRG. The net result is a *rescaling* of the DRG RVU weights and adjustment to the national standardized RVU amount. (Final RVU weights for each DRG and standardized RVU amounts for both models are shown in Appendix B.)

### 4.1.4 Transfer Cases

Under PPS, when a Medicare patient is transferred from one PPS acute-care hospital to another, the transferring hospital receives a uniform per diem payment up to the full DRG payment amount. The transfer case is assigned to a DRG and the per diem payment is calculated as the DRG payment divided by the geometric mean length of stay. Transferring hospitals are eligible to receive only cost outlier payments, and at the standard threshold level. In contrast, the receiving hospital receives the full DRG payment and is eligible for both cost and day outlier payments.

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[3] Practice cost data related to physicians on medical staffs are not available, therefore no econometric estimation of marginal practice costs for outlier cases is possible.

Hospital cost function estimations suggest that costs associated with transfer cases are highest in the first few days of the stay and decline thereafter, but at a decreasing rate (Carter and Rumpel, 1993). For medical cases transferred within three days of initial hospitalization, the cost of the first day was found to be roughly twice the per diem payment rate. Costs for the second day were also significantly greater, but to a lesser degree, than costs for subsequent days. By day 3, incremental costs were constant. For surgical cases, only the first day's costs were found to be significantly greater than subsequent days. As expected, the magnitude was greater than for medical cases, which is consistent with the resource intensity of surgical episodes.

HCFA has signaled its desire to move to a graduated per diem payment methodology; however, final regulations revising the transfer payment policy have not been promulgated. The transfer payment policy is likely to affect payment for the sending hospital only, and to take the following form:

- payment for the day of admission to the sending hospital would be twice the DRG-specific per-diem rate;
- payment for all subsequent days of stay in the sending hospital would be set at the DRG-specific per-diem rate;
- maximum payment to the sending hospital is the DRG payment amount; and
- outlier payments for cases meeting cost outlier criteria.

For our physician payment model, we created a separate file consisting of all 98,566 transfer cases (at sending hospitals) to analyze transfers. Specifically, we examine whether the RVUs per day follow a pattern that justifies an alternative to the per-diem methodology now used for Part A transfer cases.

Our descriptive analysis shows that the first day has significantly more RVUs than subsequent days. Table 4-2 shows the mean RVUs for each of the first 20 days of hospital stays at sending hospitals. The mean per day generally falls as length of stay increases. Over all DRGs, the first day has an average of 13.2 RVUs, day 2 has 6.3 RVUs, and day 3 has 6.4 RVUs. Medical DRGs show 12.1, 6.1, and 6.3 RVUs for days 1, 2 and 3, while surgical DRGs have 34.1, 8.6, and 7.1 RVUs for the first 3 days. Mean RVUs per day also tend to decline with length of stay by MDC, as shown in Table 4-3.

Although descriptive analysis reveals substantial falling off of RVUs per day, particularly within the first few days, these values do not control for case mix or severity of

TABLE 4-2

## NUMBER OF TRANSFERS, MEAN RVUs AND STANDARD DEVIATIONS FOR DAY OF STAY 1-20 IN SENDING HOSPITALS; BY ALL DRGs; MEDICAL DRGs AND SURGICAL DRGs[a]

| | All DRGs | | | MEDICAL DRGs | | | SURGICAL DRGs | | |
|---|---|---|---|---|---|---|---|---|---|
| Day | Transfers | Mean RVUs | Standard Deviation | Transfers | Mean RVUs | Standard Deviation | Transfers | Mean RVUs | Standard Deviation |
| 1 | 71,329 | 13.23 * | 17.61 | 67,908 | 12.18 * | 15.66 | 3,421 | 34.14 * | 33.80 |
| 2 | 49,211 | 6.30 | 14.30 | 46,208 | 6.14 * | 13.96 | 3,003 | 8.65 * | 18.60 |
| 3 | 35,197 | 6.44 * | 12.06 | 32,544 | 6.38 * | 11.71 | 2,653 | 7.17 * | 15.76 |
| 4 | 23,495 | 6.90 * | 13.40 | 21,178 | 7.02 | 13.47 | 2,317 | 5.86 | 12.64 |
| 5 | 14,424 | 6.63 | 12.73 | 12,394 | 6.86 * | 12.73 | 2,030 | 5.24 | 12.64 |
| 6 | 8,407 | 6.89 * | 13.08 | 6,667 | 7.40 * | 13.60 | 1,740 | 4.95 | 10.61 |
| 7 | 4,424 | 6.29 * | 11.32 | 2,973 | 6.81 * | 11.36 | 1,451 | 5.22 | 11.16 |
| 8 | 2,499 | 7.48 * | 21.48 | 1,341 | 9.42 * | 25.94 | 1,158 | 5.24 | 14.40 |
| 9 | 1,165 | 4.88 | 9.77 | 315 | 5.90 | 12.27 | 850 | 4.51 | 8.64 |
| 10 | 778 | 5.35 | 11.11 | 170 | 6.50 | 11.51 | 608 | 5.02 | 10.98 |
| 11 | 523 | 5.06 | 9.69 | 74 | 5.53 | 6.36 | 449 | 4.98 | 10.14 |
| 12 | 381 | 5.34 | 11.71 | 40 | 6.48 * | 8.63 | 341 | 5.21 | 12.02 |
| 13 | 268 | 4.99 * | 7.76 | 14 | 1.50 | 2.35 | 254 | 5.18 * | 7.90 |
| 14 | 200 | 6.84 | 10.12 | 10 | 3.64 | 3.52 | 190 | 7.01 | 10.33 |
| 15 | 137 | 5.26 | 5.71 | 4 | 3.41 | 2.95 | 133 | 5.32 | 5.76 |
| 16 | 100 | 5.07 | 5.18 | 3 | 3.78 | 4.05 | 97 | 5.11 | 5.22 |
| 17 | 89 | 5.03 | 4.86 | 2 | 5.28 | 5.61 | 87 | 5.02 | 4.88 |
| 18 | 83 | 5.42 | 6.25 | 0 | . | . | 83 | 5.42 | 6.25 |
| 19 | 77 | 4.59 | 5.36 | 0 | . | . | 77 | 4.59 | 5.36 |
| 20 | 73 | 4.16 | 4.06 | 0 | . | . | 73 | 4.16 | 4.06 |

**NOTES:**

*Denotes that mean is statistically different from the following day's RVU mean at the 5% significance level.

(a) Excludes cases with length-of-stay > geometric mean length-of-stay for each DRG.

SOURCE: HER analysis of 1992 HCFA Episode Data Base.

TABLE 4-3

## NUMBER OF TRANSFERS, MEAN RVUs AND STANDARD DEVIATIONS FOR DAY 1 - 20 SENDING HOSPITALS; BY MDC (a)

| | MDC 1: DISEASES AND DISORDERS OF THE NERVOUS SYSTEM | | | MDC 2: DISEASES AND DISORDERS OF THE EYE | | | MDC 3: DISEASES AND DISORDERS OF THE EAR, NOSE, MOUTH AND THROAT | | | MDC 4: DISEASES AND DISORDERS OF THE RESPIRATORY SYSTEM | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Day | Transfers | Mean RVUs | Standard Deviation | Transfers | Mean RVUs | Standard Deviation | Transfers | Mean RVUs | Standard Deviation | Transfers | Mean RVUs | Standard Deviation |
| 1 | 4,962 | 14.00 * | 17.45 | 94 | 21.02 * | 23.52 | 221 | 12.95 * | 18.81 | 5,521 | 9.72 * | 11.23 |
| 2 | 3,089 | 6.21 * | 14.12 | 35 | 4.09 | 6.97 | 121 | 4.74 | 7.74 | 4,171 | 4.31 | 7.23 |
| 3 | 2,160 | 5.30 | 9.39 | 18 | 3.49 | 3.89 | 73 | 6.28 | 8.73 | 3,316 | 4.25 * | 6.15 |
| 4 | 1,464 | 5.16 | 8.79 | 9 | 24.82 | 48.86 | 30 | 4.25 | 4.76 | 2,584 | 4.61 | 7.21 |
| 5 | 950 | 4.93 | 8.98 | 3 | 5.93 | 5.20 | 14 | 4.23 | 4.37 | 1,857 | 4.54 * | 7.51 |
| 6 | 634 | 5.27 | 10.87 | 0 | -- | -- | 3 | 7.54 | 9.44 | 1,290 | 5.11 | 7.82 |
| 7 | 380 | 6.49 | 12.75 | 0 | -- | -- | 1 | 20.30 | -- | 822 | 5.27 | 6.80 |
| 8 | 177 | 5.78 | 8.52 | 0 | -- | -- | 0 | -- | -- | 456 | 5.92 | 10.96 |
| 9 | 53 | 5.39 | 10.49 | 0 | -- | -- | 0 | -- | -- | 270 | 6.22 | 12.53 |
| 10 | 27 | 2.85 | 2.82 | 0 | -- | -- | 0 | -- | -- | 178 | 7.10 | 11.69 |
| 11 | 17 | 2.51 | 2.97 | 0 | -- | -- | 0 | -- | -- | 81 | 6.73 | 7.43 |
| 12 | 10 | 2.34 | 2.17 | 0 | -- | -- | 0 | -- | -- | 35 | 9.26 | 9.79 |
| 13 | 3 | 12.93 | 11.28 | 0 | -- | -- | 0 | -- | -- | 0 | -- | -- |
| 14 | 0 | -- | -- | 0 | -- | -- | 0 | -- | | 0 | -- | -- |
| 15 | 0 | -- | -- | 0 | -- | -- | 0 | -- | -- | 0 | -- | -- |
| 16 | 0 | -- | -- | 0 | -- | -- | 0 | -- | -- | 0 | -- | -- |
| 17 | 0 | -- | -- | 0 | -- | -- | 0 | -- | -- | 0 | -- | -- |
| 18 | 0 | -- | -- | 0 | -- | -- | 0 | -- | -- | 0 | -- | -- |
| 19 | 0 | -- | -- | 0 | -- | -- | 0 | -- | -- | 0 | -- | -- |
| 20 | 0 | -- | -- | 0 | -- | -- | 0 | -- | -- | 0 | -- | -- |

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TABLE 4-3 (continued)

NUMBER OF TRANSFERS, MEAN RVUs AND STANDARD DEVIATIONS FOR DAY 1 - 20 SENDING HOSPITALS; BY MDC (a)

| | MDC 5: DISEASES AND DISORDERS OF THE CIRCULATORY SYSTEM | | | MDC 6: DISEASES AND DISORDERS OF THE DIGESTIVE SYSTEM | | | MDC7: DISEASES AND DISORDERS OF THE HEPATOBILIARY SYSTEM AND PANCREAS | | | MDC8: DISEASES AND DISORDERS OF THE MUSCULOSKELETAL SYSTEM AND CONNECTIVE TISSUE | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Day | Transfers | Mean RVUs | Standard Deviation | Transfers | Mean RVUs | Standard Deviation | Transfers | Mean RVUs | Standard Deviation | Transfers | Mean RVUs | Standard Deviation |
| 1 | 44,466 | 13.56 * | 18.54 | 3,906 | 14.06 * | 15.82 | 2,126 | 12.02 * | 11.81 | 2,703 | 18.51 * | 23.44 |
| 2 | 30,364 | 6.93 * | 16.20 | 2,467 | 6.38 | 10.88 | 1,572 | 5.62 | 8.57 | 1,850 | 5.28 * | 12.13 |
| 3 | 21,462 | 7.43 * | 13.74 | 1,713 | 5.81 | 10.39 | 1,121 | 5.99 | 9.76 | 1,446 | 3.97 | 7.96 |
| 4 | 13,590 | 8.33 | 15.70 | 1,160 | 6.20 | 11.52 | 763 | 5.78 | 8.60 | 1,088 | 4.10 | 10.43 |
| 5 | 7,497 | 8.41 * | 15.60 | 753 | 5.72 | 10.20 | 512 | 5.25 | 7.09 | 847 | 3.98 | 9.55 |
| 6 | 3,761 | 9.24 * | 16.85 | 446 | 5.75 | 10.76 | 310 | 6.39 * | 8.94 | 599 | 3.73 | 7.05 |
| 7 | 1,539 | 8.07 * | 13.94 | 253 | 5.68 | 10.22 | 150 | 4.35 | 6.53 | 378 | 3.31 | 6.50 |
| 8 | 782 | 11.52 * | 32.49 | 183 | 5.30 | 11.04 | 84 | 6.22 | 9.35 | 240 | 4.42 | 12.45 |
| 9 | 147 | 5.40 | 13.38 | 129 | 4.63 | 11.56 | 31 | 3.82 | 4.44 | 124 | 3.84 | 7.96 |
| 10 | 99 | 3.83 | 6.50 | 92 | 3.73 | 7.64 | 19 | 2.25 | 2.37 | 56 | 2.91 | 3.37 |
| 11 | 67 | 5.03 | 15.88 | 72 | 5.14 | 14.21 | 16 | 3.82 | 5.28 | 22 | 2.96 | 3.01 |
| 12 | 50 | 5.12 | 14.52 | 52 | 3.15 | 4.73 | 7 | 3.46 | 4.81 | 15 | 2.62 | 3.79 |
| 13 | 29 | 2.06 | 2.36 | 38 | 4.77 * | 5.78 | 7 | 5.88 | 9.88 | 12 | 2.79 | 4.59 |
| 14 | 19 | 2.73 | 2.87 | 21 | 13.28 | 15.96 | 5 | 6.55 | 5.81 | 6 | 5.92 | 6.40 |
| 15 | 11 | 4.24 | 6.73 | 2 | 10.83 | 10.08 | 1 | 5.14 | -- | 3 | 1.15 | 0.72 |
| 16 | 5 | 3.05 | 3.33 | 0 | -- | -- | 1 | 15.42 | -- | 1 | 3.55 | -- |
| 17 | 2 | 5.28 | 5.61 | 0 | -- | -- | 0 | -- | -- | 0 | -- | -- |
| 18 | 0 | -- | -- | 0 | -- | -- | 0 | -- | -- | 0 | -- | -- |
| 19 | 0 | -- | -- | 0 | -- | -- | 0 | -- | -- | 0 | -- | -- |
| 20 | 0 | -- | -- | 0 | -- | -- | 0 | -- | -- | 0 | -- | -- |

TABLE 4-3 (continued)

NUMBER OF TRANSFERS, MEAN RVUs AND STANDARD DEVIATIONS FOR DAY 1 - 20 SENDING HOSPITALS; BY MDC (a)

| | MDC 9: DISEASES AND DISORDERS OF THE SKIN, SUBCUTANEOUS TISSUE AND BREAST | | | MDC 10: ENDOCRINE, NUTRITIONAL AND METABOLIC DISEASES AND DISORDERS | | | MDC 11: DISEASES AND DISORDERS OF THE KIDNEY AND URINARY TRACT | | | MDC 12: DISEASES AND DISORDERS OF THE MALE REPRODUCTIVE SYSTEM | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Day | Transfers | Mean RVUs | Standard Deviation | Transfers | Mean RVUs | Standard Deviation | Transfers | Mean RVUs | Standard Deviation | Transfers | Mean RVUs | Standard Deviation |
| 1 | 559 | 7.69 * | 7.58 | 940 | 3.42 * | 8.73 | 1,839 | 10.92 * | 11.67 | 181 | 24.18 * | 34.17 |
| 2 | 440 | 3.80 | 12.53 | 691 | 3.49 | 5.12 | 1,201 | 5.21 | 9.11 | 133 | 4.65 | 9.86 |
| 3 | 361 | 3.33 | 4.67 | 506 | 3.91 | 7.53 | 800 | 5.21 | 8.35 | 96 | 4.93 | 7.81 |
| 4 | 280 | 3.21 | 4.13 | 357 | 4.26 | 7.86 | 518 | 5.09 | 7.56 | 59 | 6.31 | 7.95 |
| 5 | 211 | 3.31 | 5.48 | 215 | 4.77 | 7.01 | 346 | 4.24 | 5.27 | 30 | 10.55 | 16.18 |
| 6 | 145 | 3.81 | 7.48 | 112 | 5.44 | 6.40 | 221 | 4.71 * | 5.96 | 10 | 5.37 * | 7.02 |
| 7 | 100 | 4.93 | 9.14 | 30 | 6.18 | 12.26 | 116 | 6.72 | 5.62 | 4 | 0.43 | 0.69 |
| 8 | 42 | 4.47 | 5.71 | 20 | 2.17 | 2.97 | 26 | 4.97 | 5.52 | 2 | 44.07 | 62.32 |
| 9 | 28 | 4.05 | 6.30 | 18 | 3.00 | 5.15 | 14 | 3.68 | 2.85 | 0 | -- | -- |
| 10 | 16 | 3.24 | 5.08 | 14 | 4.42 | 6.66 | 6 | 5.98 * | 4.18 | 0 | -- | -- |
| 11 | 12 | 1.95 | 1.81 | 9 | 2.91 | 4.22 | 2 | 2.26 | 0.40 | 0 | -- | -- |
| 12 | 8 | 1.92 | 1.80 | 5 | 1.12 | 1.65 | 1 | 0.00 | -- | 0 | -- | -- |
| 13 | 6 | 2.39 | 3.81 | 3 | 2.34 | 4.06 | 0 | -- | -- | 0 | -- | -- |
| 14 | 4 | 1.92 | 1.45 | 1 | 0.00 | -- | 0 | -- | -- | 0 | -- | -- |
| 15 | 2 | 3.91 | 3.14 | 0 | -- | -- | 0 | -- | -- | 0 | -- | -- |
| 16 | 0 | -- | -- | 0 | -- | -- | 0 | -- | -- | 0 | -- | -- |
| 17 | 0 | -- | -- | 0 | -- | -- | 0 | -- | -- | 0 | -- | -- |
| 18 | 0 | -- | -- | 0 | -- | -- | 0 | -- | -- | 0 | -- | -- |
| 19 | 0 | -- | -- | 0 | -- | -- | 0 | -- | -- | 0 | -- | -- |
| 20 | 0 | -- | -- | 0 | -- | -- | 0 | -- | -- | 0 | -- | -- |

TABLE 4-3 (continued)

NUMBER OF TRANSFERS, MEAN RVUs AND STANDARD DEVIATIONS FOR DAY 1 - 20 SENDING HOSPITALS; BY MDC (a)

| | MDC 13: DISEASES AND DISORDERS OF THE FEMALE REPRODUCTIVE SYSTEM | | | MDC 14: PREGNANCY, CHILDBIRTH AND THE PUERPERIUM | | | MDC 16: DISEASES AND DISORDERS OF THE BLOOD AND BLOOD FORMING ORGANS AND IMMUNOLOGICAL DISORDERS | | | MDC 17: MYELOPROLIFERATIVE DISEASES AND DISORDERS, AND POORLY DIFFERENTIATED NEOPLASMS | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Day | Transfers | Mean RVUs | Standard Deviation | Transfers | Mean RVUs | Standard Deviation | Transfers | Mean RVUs | Standard Deviation | Transfers | Mean RVUs | Standard Deviation |
| 1 | 146 | 15.09 * | 16.21 | 24 | 14.97 | 22.02 | 433 | 9.33 * | 9.41 | 562 | 10.63 * | 7.84 |
| 2 | 112 | 4.88 | 10.50 | 8 | 5.37 | 9.09 | 274 | 4.63 | 5.87 | 443 | 4.65 | 6.13 |
| 3 | 88 | 6.54 | 16.74 | 2 | 4.19 | 1.65 | 175 | 4.98 | 7.88 | 364 | 5.26 * | 7.98 |
| 4 | 48 | 3.77 | 5.17 | 1 | 23.27 | -- | 105 | 3.99 | 4.44 | 278 | 4.06 | 4.65 |
| 5 | 41 | 4.15 | 10.47 | 0 | -- | -- | 52 | 4.69 | 6.75 | 215 | 4.28 | 5.51 |
| 6 | 26 | 3.08 | 3.97 | 0 | -- | -- | 10 | 4.79 | 5.24 | 168 | 4.73 | 5.94 |
| 7 | 13 | 3.50 | 3.86 | 0 | -- | -- | 4 | 2.25 | 2.75 | 117 | 4.16 | 4.47 |
| 8 | 5 | 1.83 * | 1.94 | 0 | -- | -- | 3 | 0.51 | 0.66 | 75 | 5.21 | 5.91 |
| 9 | 2 | 4.53 | 0.87 | 0 | -- | -- | 3 | 2.61 | 3.71 | 41 | 4.40 | 5.46 |
| 10 | 1 | 4.02 | -- | 0 | -- | -- | 2 | 0.86 | 0.83 | 15 | 2.90 | 3.11 |
| 11 | 0 | -- | -- | 0 | -- | -- | 1 | 1.44 | -- | 9 | 8.03 | 8.56 |
| 12 | 0 | -- | -- | 0 | -- | -- | 1 | 5.41 | -- | 4 | 8.86 | 6.49 |
| 13 | 0 | -- | -- | 0 | -- | -- | 0 | -- | -- | 0 | -- | -- |
| 14 | 0 | -- | -- | 0 | -- | -- | 0 | -- | -- | 0 | -- | -- |
| 15 | 0 | -- | -- | 0 | -- | -- | 0 | -- | -- | 0 | -- | -- |
| 16 | 0 | -- | -- | 0 | -- | -- | 0 | -- | -- | 0 | -- | -- |
| 17 | 0 | -- | -- | 0 | -- | -- | 0 | -- | -- | 0 | -- | -- |
| 18 | 0 | -- | -- | 0 | -- | -- | 0 | -- | -- | 0 | -- | -- |
| 19 | 0 | -- | -- | 0 | -- | -- | 0 | -- | -- | 0 | -- | -- |
| 20 | 0 | -- | -- | 0 | -- | -- | 0 | -- | -- | 0 | -- | -- |

TABLE 4-3 (continued)

NUMBER OF TRANSFERS, MEAN RVUs AND STANDARD DEVIATIONS FOR DAY 1 - 20 SENDING HOSPITALS; BY MDC (a)

| | MDC 18: INFECTIOUS AND PARASITIC DISEASES | | | MDC 19: MENTAL DISEASES AND DISORDERS | | | MDC 20: ALCOHOL/DRUG USE AND ALCOHOL/DRUG INDUCED ORGANIC MENTAL DISORDERS | | | MDC 21: INJURIES, POISONINGS AND TOXIC EFFECTS OF DRUGS | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Day | Transfers | Mean RVUs | Standard Deviation | Transfers | Mean RVUs | Standard Deviation | Transfers | Mean RVUs | Standard Deviation | Transfers | Mean RVUs | Standard Deviation |
| 1 | 1,067 | 11.20 * | 13.50 | 312 | 7.31 * | 5.21 | 310 | 5.03 * | 4.17 | 335 | 13.35 * | 19.15 |
| 2 | 786 | 5.30 | 8.91 | 231 | 3.55 | 3.49 | 231 | 2.35 | 3.18 | 172 | 4.70 | 7.92 |
| 3 | 607 | 4.83 | 6.91 | 165 | 3.34 | 4.48 | 172 | 2.04 | 3.03 | 92 | 4.49 | 8.87 |
| 4 | 451 | 4.81 | 12.01 | 124 | 3.04 | 3.19 | 121 | 2.09 | 2.18 | 45 | 5.73 | 11.15 |
| 5 | 340 | 5.03 | 7.73 | 81 | 2.40 * | 2.40 | 69 | 2.16 | 2.90 | 17 | 4.93 | 9.69 |
| 6 | 223 | 5.12 | 9.70 | 60 | 3.84 | 5.25 | 39 | 2.45 * | 2.56 | 8 | 1.51 | 1.64 |
| 7 | 144 | 6.50 | 9.22 | 39 | 2.80 | 2.33 | 22 | 1.25 | 1.34 | 5 | 6.87 | 8.52 |
| 8 | 88 | 5.57 | 7.47 | 25 | 2.00 | 1.81 | 21 | 0.99 | 1.27 | 3 | 7.89 | 4.76 |
| 9 | 44 | 4.05 | 4.06 | 13 | 3.29 | 2.36 | 17 | 1.10 | 1.77 | 1 | 1.69 | -- |
| 10 | 35 | 4.46 | 5.40 | 4 | 1.52 | 1.30 | 14 | 1.02 | 1.52 | 1 | 20.50 | -- |
| 11 | 29 | 3.56 | 3.38 | 1 | 0.00 | -- | 13 | 1.29 | 1.83 | 0 | -- | -- |
| 12 | 24 | 3.99 | 4.13 | 1 | 0.00 | -- | 9 | 1.11 | 1.00 | 0 | -- | -- |
| 13 | 21 | 4.61 | 4.82 | 1 | 0.00 | -- | 8 | 1.14 | 1.86 | 0 | -- | -- |
| 14 | 16 | 12.25 | 19.86 | 1 | 0.00 | -- | 5 | 2.54 | 3.22 | 0 | -- | -- |
| 15 | 8 | 2.91 * | 3.04 | 0 | -- | -- | 1 | 6.98 | -- | 0 | -- | -- |
| 16 | 3 | 7.04 | 2.12 | 0 | -- | -- | 0 | -- | -- | 0 | -- | -- |
| 17 | 0 | -- | -- | 0 | -- | -- | 0 | -- | -- | 0 | -- | -- |
| 18 | 0 | -- | -- | 0 | -- | -- | 0 | -- | -- | 0 | -- | -- |
| 19 | 0 | -- | -- | 0 | -- | -- | 0 | -- | -- | 0 | -- | -- |
| 20 | 0 | -- | -- | 0 | -- | -- | 0 | -- | -- | 0 | -- | -- |

TABLE 4-3 (continued)

NUMBER OF TRANSFERS, MEAN RVUs AND STANDARD DEVIATIONS FOR DAY 1 - 20 SENDING HOSPITALS; BY MDC (a)

| | MDC22: BURNS | | | MDC23: FACTORS INFLUENCING HEALTH STATUS AND OTHER CONTACTS WITH HEALTH SERVICES | | | MDC24: MULTIPLE SIGNIFICANT TRAUMA | | | MDC25: HUMAN IMMUNODEFICIENCY VIRUS INFECTIONS | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Day | Transfers | Mean RVUs | Standard Deviation | Transfers | Mean RVUs | Standard Deviation | Transfers | Mean RVUs | Standard Deviation | Transfers | Mean RVUs | Standard Deviation |
| 1 | 4 | 4.22 | 3.37 | 72 | 9.19 * | 8.76 | 79 | 28.74 * | 29.20 | 17 | 7.82 | 6.62 |
| 2 | 3 | 2.11 | 1.24 | 38 | 4.09 | 3.42 | 50 | 5.65 | 11.01 | 14 | 4.26 | 4.28 |
| 3 | 2 | 3.55 | 3.63 | 22 | 5.50 | 9.38 | 36 | 3.31 | 7.44 | 9 | 3.79 | 5.00 |
| 4 | 2 | 1.45 | 0.66 | 15 | 5.63 | 6.35 | 32 | 3.03 | 3.23 | 7 | 2.28 | 2.51 |
| 5 | 1 | 0.98 | -- | 10 | 2.58 | 1.76 | 23 | 3.39 | 3.88 | 5 | 5.77 | 4.57 |
| 6 | 1 | 2.31 | -- | 7 | 2.88 | 2.31 | 18 | 4.04 | 5.64 | 4 | 3.49 | 1.74 |
| 7 | 1 | 1.69 | -- | 2 | 0.98 | 1.39 | 16 | 2.05 | 2.33 | 4 | 4.44 | 4.10 |
| 8 | 0 | -- | -- | 2 | 0.98 | 1.39 | 13 | 3.86 | 7.00 | 2 | 3.58 | 0.23 |
| 9 | 0 | -- | -- | 2 | 3.70 | 5.23 | 10 | 4.04 | 4.45 | 2 | 4.40 | 1.39 |
| 10 | 0 | -- | -- | 1 | 0.00 | -- | 5 | 3.74 | 3.10 | 2 | 5.70 | 3.88 |
| 11 | 0 | -- | -- | 1 | 0.00 | -- | 3 | 3.15 | 1.49 | 2 | 8.39 | 7.22 |
| 12 | 0 | -- | -- | 1 | 6.35 | -- | 0 | -- | -- | 2 | 4.07 | 0.93 |
| 13 | 0 | -- | -- | 0 | -- | -- | 0 | -- | -- | 2 | 3.18 | 0.33 |
| 14 | 0 | -- | -- | 0 | -- | -- | 0 | -- | -- | 2 | 5.37 | 1.56 |
| 15 | 0 | -- | -- | 0 | -- | -- | 0 | -- | -- | 2 | 3.18 | 1.07 |
| 16 | 0 | -- | -- | 0 | -- | -- | 0 | -- | -- | 1 | 3.41 | -- |
| 17 | 0 | -- | -- | 0 | -- | -- | 0 | -- | -- | 1 | 14.29 | -- |
| 18 | 0 | -- | -- | 0 | -- | -- | 0 | -- | -- | 0 | -- | -- |
| 19 | 0 | -- | -- | 0 | -- | -- | 0 | -- | -- | 0 | -- | -- |
| 20 | 0 | -- | -- | 0 | -- | -- | 0 | -- | -- | 0 | -- | -- |

**NOTES:**

*Denotes that mean is statistically different from the following day's RVU mean at the 5% significance level.

(a) Excludes cases with length-of-stay > geometric mean length-of-stay for each DRG.

SOURCE: HER analysis of 1992 HCFA Episode Data Base.

DRGs. We conducted multivariate analyses to test for significant changes in daily RVUs as length of stay increases, controlling for severity and teaching status of the sending hospital. The regression analyses reveal that for medical DRGs, the first day of the stay is approximately 50 percent more resource intensive than the daily average while the second day is 25 percent more intensive. For surgical cases, however, even though statistical significance was found between the first few days of the stay, the magnitude of the coefficients does not support a graduated per diem payment. The results in our surgical DRG sample regression indicate that when DRG severity--measured by the DRG weight divided by the DRG's length of stay--is controlled for, on average the intensity within day 1 of the stay is not much greater in magnitude than the average per day. This finding contrasts with the descriptive results in Table 4-2, where simple means of daily RVUs are compared across days within the stay for surgical DRG cases. This discrepancy is explained by the fact that the regression [illegible] controlled for DRG severity. The weights for surgical DRGs are generally higher than those for medical DRGs. Once we take into account that higher weight DRGs would receive higher per diem payments anyway, there is no apparent justification for a graduated per diem

In Table 4-4, regression results are shown for a sample of surgical DRG cases and for a sample of medical DRG cases. We separated the surgical cases from medical cases for purposes of examining systematic patterns of resource intensity within a stay, as done by Carter and Rumpel (1993). The regression model uses RVUs per day for the individual case as the dependent variable. Independent variables include number of RVUs by day of stay (days 1, 2, 3, 4, 5 and days greater than 5) and a dummy variable for teaching status. We construct the RVUs for day 1, for example, by taking the observed number of RVUs on day 1 for the case and multiplying it by the case's DRG RVU weight and dividing by the DRG's geometric mean LOS. In other words, the RVU total for day 1 is multiplied by the daily DRG RVU weight. Using this construct, we are able to control for case severity across cases within the surgical and medical DRG samples. The model attempts to explain how average daily RVUs per stay vary by resource intensity within a particular day of stay, especially the first few days. Recall, that our purpose is to examine whether resource intensity for any specific day (particularly the first few) is systematically much greater than the average per day for the case.

The coefficient for day 1 for surgical DRG cases is 1.433, and suggests that the increase in resource intensity is only 8.4 percent above the daily average. That is, the change in average daily RVUs from the first day of a surgical stay is 1.433 RVUs, or an increase of 8.4 percent. The second day's coefficient of 0.95 reveals an increase in daily average intensity of 5.5 percent. For the medical DRG sample, the first day's coefficient is 6.236, which indicates a 54.7 percent

TABLE 4-4

## TRANSFER REGRESSION MODEL: DAILY AVERAGE RVUs PER CASE REGRESSED ON DAY OF STAY RVUs

| | SURGICAL DRGs | | MEDICAL DRGs | |
|---|---|---|---|---|
| Variable | Coefficient | Increased Intensity (a) | Coefficient | Increased Intensity (a) |
| Day 1 RVUs (b) | 1.433 ***<br>(0.032) | 8.4% | 6.236 ***<br>(0.017) | 54.7% |
| Day 2 RVUs (b) | 0.950 ***<br>(0.075) | 5.5 | 2.504 ***<br>(0.019) | 21.9 |
| Day 3 RVUs (b) | 0.536 ***<br>(0.098) | 3.1 | 0.857 ***<br>(0.030) | 7.5 |
| Day 4 RVUs (b) | 0.013<br>(0.143) | 0.1 | 0.524<br>(0.034) | 4.6 |
| Day 5 RVUs (b) | 0.156<br>(0.134) | 9.0 | -0.062<br>(0.045) | -0.5 |
| RVUs After Day 5 (b) | -0.455 ***<br>(0.072) | -2.7 | 0.041 ***<br>(0.048) | 0.4 |
| Teaching Dummy | 0.761 ***<br>(0.052) | 4.4 | 0.259 ***<br>(0.005) | 2.3 |
| No. of Discharges | 3,394 | | 67,486 | |
| Mean RVU Per Day | 17.15 | | 11.41 | |

**NOTES:**

(a) Increased intensity above the mean daily RVUs, measured as coefficient/mean daily RVUs.

(b) RVUs are multipled by the daily DRG RVU weight, which equals the DRG RVU weight divided by mean length-of-stay.

Dependent Variable equals RVUs per day.

Sample includes only discharges whose length of stay is less than or equal to the DRG geometric mean LOS.

Standard errors in parentheses beneath coefficients.

*** Significant at the 1% level of significance or better.

increase in average daily resource intensity. The increase in daily average resource intensity from day 2 is 21.9 percent, given its coefficient of 2.504.

We defined our graduated per-diem transfer payment policy for our PSO and FPS models using the regression results from Table 4-4.[4] A transfer case in a sending hospital in a medical DRG would receive a graduated per diem payment of 150 percent of the daily per diem RVU (based on the daily average number of RVUs over all cases from the respective DRG) for the first day of stay, 125 percent of the daily per diem RVU amount for day 2, and the daily per diem amount for all subsequent days; all adjusted by the relevant geographic adjustment factor. Surgical DRG transfer cases in sending hospitals would be paid the daily per diem RVU amount for the respective DRG, adjusted by a geographic adjustment factor. Transfer payments are capped at the DRG payment for nontransfer cases. However, transfer cases are subject to the same outlier policy as all other cases and can qualify for cost outlier payments. Teaching adjustments are applied to the per diem and outlier payments for teaching hospitals.

### 4.1.5 Teaching and Disproportionate Share Adjustments

A critical feature in a prospective payment system is any factor used to standardize the base costs or units and to adjust the final prospective payment amounts. This section describes our analysis of two potential adjustment terms--an indirect medical education (IME) adjustment factor and a disproportionate share (DSH) adjustment term--under two direct medical education (DME) policy options. The first DME policy option is essentially the status quo while the second option directly incorporates the implicit value of resident-provided services.

Medicare reimburses hospitals for the indirect costs of teaching, i.e., those costs emanating from the teaching program at the hospital but are difficult to directly assign to various cost centers. The teaching activity or IME adjustment is undertaken to "control" for the higher patient care costs found in teaching hospitals due, in part, to the teaching of interns and residents. An IME adjustment to the PPS payment was deemed necessary to limit the financial risk teaching hospitals would bear under the PPS, given the greater intensity of care provided and the essential role these facilities play in training medical care providers.

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[4] For administrative ease, we rounded the graduated per diem payments from the medical DRG regression coefficients. For surgical cases, the small intensity increases did not justify the increased administrative complexity associated with small graduated per diem payments.

Medicare pays qualifying hospitals a disproportionate share (DSH) add-on to their PPS payments. The purpose for the DSH was to maintain equity in PPS across all hospitals by recognizing the higher costs observed in hospitals serving greater proportions of indigent patients. While the explicit objective of PPS was to pay only Medicare's share of hospital costs, the DSH was considered necessary to preserve access to high quality care.

We assess the appropriateness of an IME and DSH adjustment in our bundled payment models, under both DME options, using multiple regression analysis similar to that done for the current IME policy for Medicare Part A payments. Our estimation of the IME adjustment under the first policy indicates that teaching intensity is *negatively* correlated with the number of RVUs per episode, thus resulting in a *negative* IME RVU adjustment for teaching medical staffs. This result is consistent with previous research by Miller and Welch (1993) who found that teaching intensity (measured as the intern/resident-bed ratio, IRB) was negative and significant in regressions with the number of casemix-adjusted RVUs per admission. Also, Mitchell *et al.* (1994) found similar results for their hospital-level and admission-level regression models. These findings indicate that residents are substituting for physicians and that all physician services in teaching hospitals need to be adjusted downward to offset DME Part A payments used to compensate residents for providing physician services.[5] The DSH adjustment under the first DME policy would be negative.

As done under DME policy option 1, we estimated the IME and DSH RVU adjustments to the PSO and FPS models under DME policy option 2. Our IME and DSH regressions, which were specified to include DME RVUs in the dependent variable, show teaching intensity to be *positively* correlated with the number of RVUs per episode, resulting in a *positive* IME RVU adjustment for teaching medical staffs. The DSH adjustment again was found to be negative. Miller and Welch (1993) found that teaching intensity was positive and significant in regressions that included residents' RVUs with the number of casemix-adjusted RVUs per admission. Mitchell *et al.* (1994) similarly found a positive effect from teaching intensity when DME was included in the dependent variable for both their hospital-level and admission-level regression models. A positive correlation between RVUs per case and teaching intensity in the second PSO model may indicate that incorporating the value of resident-provided services does not completely capture all physician services in teaching hospitals. This may result from the fact that DRG RVU amounts increase (prior to standardization by IME) for all medical staffs, not just for teaching medical staffs. Adequate payment for all teaching activity in medical staffs, therefore, requires a positive IME adjustment to the PSO and FPS model payments.

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[5] Although physician payments in teaching hospitals would be adjusted downward through an IME adjustment, during the standardization process the number of RVUs is actually increased because of the division of RVUs by 1 plus a negative IME adjustment (which is less than 1.0).

Table 4-5 contains the multivariate results from two regression models, both estimated using two different dependent variables consistent with our DME policy options. The first dependent variable is the natural log of the mean total RVUs per discharge, adjusted for casemix, for each hospital. This hospital casemix measure is comparable to the CMI under PPS, but is calculated from the RVUs from physician services provided in that hospital. This dependent variable is consistent with our first DME policy option. The second dependent variable combines DMERVUs, which are a measure of resident-provided physician services in teaching hospitals, with the number of RVUs per case. We construct this variable to examine the second policy option for DME.

The first model in Table 4-5, Specification # 1, is the original PPS IME regression model, but including the log of disproportionate share [ln(DSH)]. That is, we regress casemix-adjusted RVUs per case on the log of beds [ln(beds)], the log of teaching intensity [ln(IRB)], ln(DSH), and three MSA dummy variables (large MSA, medium MSA, and small MSA). In column 1, the coefficient on ln(IRB) is significant and negative (-0.526) while the ln(DSH) coefficient is -0.288 and significant. These estimates would imply negative IME and DSH adjustments, even after controlling for MSA size and bed size. For instance, a 10 percentage point increase in IRB would suggest that RVUs per case be reduced by 5.26 percent based solely on this coefficient. A 10 percentage point increase in the medical staff's (i.e., hospital's) DSH would result in RVUs per case being lowered by 2.88 percent. The MSA dummy variables are all positive, with the medium and small MSA coefficients significantly different from zero. (Rural hospitals are the omitted category.)

Rerunning the first model using the dependent variable including DMERVUs effectively reverses the sign for the ln(IRB) coefficient and reduces the magnitude of the ln(DSH) coefficient. Specifically, when DMERVUs are accounted for in the independent variable, a 10 percentage point increase in the hospital's IRB would result in a positive IME adjustment to the prospective payment of 7.14 percent. The disproportionate share reduction to the prospective payment would be only 0.56 percent for a 10 percentage point increase in the hospital's DSH. The three MSA dummies do not change appreciably across the two regressions. The R-square increases dramatically when DMERVUs are included in the dependent variable, rising from 0.24 to 0.60. This result suggests that the variables in the model are correlated with resident physician service activity. Conversely, these variables explain relatively little of the variation in "billed" physician services.

The second specification is similar to the first except that eight DSH categories are used in place of the ln(DSH). We selected this specification to test for threshold effects for DSH on

TABLE 4-5

## REGRESSION ANALYSIS OF DISPROPORTIONATE SHARE AND INDIRECT MEDICAL EDUCATION FOR FOR DRG-BASED PHYSICIAN PAYMENTS

| | SPECIFICATION #1 (a) | | SPECIFICATION #2 (b) | |
|---|---|---|---|---|
| Independent Variable | w/o DMERVUs | w/ DMERVUs | w/o DMERVUs | w/ DMERVUs |
| ln(beds) | 0.116 *** | 0.155 *** | 0.113 *** | 0.155 *** |
| | (20.25) | (38.52) | (19.79) | (38.24) |
| ln(IRB) (c) | -0.526 *** | 0.714 *** | -0.550 *** | 0.711 *** |
| | -(14.73) | (27.94) | -(15.46) | (27.75) |
| ln(DSH) (d) | -0.288 *** | -0.056 * | --- | --- |
| | -(8.32) | -(2.29) | | |
| DSHDV1 (e) | --- | -- | 0.023 | 0.003 |
| | | | (1.40) | (0.25) |
| DSHDV2 (e) | | --- | 0.021 | -0.004 |
| | | | (1.27) | -(0.33) |
| DSHDV3 (e) | --- | --- | 0.016 | -0.001 |
| | | | (0.96) | -(0.09) |
| DSHDV4 (e) | --- | --- | 0.020 | -0.013 |
| | | | (1.12) | -(1.00) |
| DSHDV5 (e) | --- | --- | 0.044 * | 0.010 |
| | | | (2.22) | (0.72) |
| DSHDV6 (e) | --- | --- | 0.041 * | 0.005 |
| | | | (1.99) | (0.36) |
| DSHDV7 (e) | --- | --- | 0.013 | -0.013 |
| DSHDV8 (e) | --- | --- | -0.155 *** | -0.033 *** |
| Large MSA | 0.195 | 0.183 | 0.211 | 0.184 |
| | (19.31) | (25.56) | (20.69) | (25.30) |
| Mid-size MSA | 0.143 *** | 0.122 *** | 0.149 *** | 0.123 *** |
| | (11.14) | (13.50) | (11.69) | (13.61) |
| Small MSA | 0.108 *** | 0.094 *** | 0.111 *** | 0.095 *** |
| | (7.96) | (9.87) | (8.19) | (9.92) |
| Intercept | 2.619 *** | 2.410 *** | 2.567 *** | 2.405 *** |
| | (89.12) | (116.52) | (81.69) | (108.03) |
| R-square | 0.24 | 0.60 | 0.25 | 0.60 |
| N | 5275 | 5219 | 5293 | 5236 |

**NOTES:**

Dependent variable is a hospital measure of CMI-adjusted RVUs/discharge, with and without direct medical education RVUs (DMERVUs).

(a) Specification #1 is the original PPS IME specification, including DSH. (jobs: mddrg037.req [RB15CC]; mddrg037.req [RB36])

(b) Specification #2 replaces ln(DSH) in Specification #1 with DSH categories. (jobs: mddrg037.req [RB15CC]; mddrg037.req [RB36]).

(c) IRB is (interns + residents)/beds.

(d) DSH is disproportionate share.

(e) DSHDV1 = 0.05 < DSHPCT < 0.10; DSHDV2 = 0.10 < DSHPCT < 0.15; DSHDV3 = 0.15 < DSHPCT < 0.20; DSHDV4 = 0.20 < DSHPCT < 0.25; DSHDV5 = 0.2 DSHPCT < 0.30; DSHDV6 = 0.30 <DSHPCT < 0.35; DSHDV7 =0.35 < DSHPCT < 0.45; DSHDV8 = 0.45 <DSHPCT

SOURCE: HER analysis of an analytic file built from the Episode Database, PPS-8 HCRIS data, and fields from the IMPACT file.

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RVUs per case. Using RVUs without DMERVUs shows a significant coefficient of -0.55 for ln(IRB). Seven of the eight DSH category dummies are positive but none of these are significant at the 5 percent level or better. The largest DSH category (DSHDV8) represents those hospitals with a DSH of 45 percent or more and is negative and significant. The model's estimates indicate that these hospitals would receive a negative DSH adjustment to their bundled physician payments. The three MSA dummies are similar in magnitude and significance to those in the first specification.

Adding DMERVUs to the dependent variable and rerunning the model again leads to a positive and significant ln(IRB) coefficient (0.711), while all the DSH category dummies are insignificant except for the largest DSH category. The DSHDV8 coefficient falls to -0.033 and remains statistically significant. The three MSA coefficients fall slightly in magnitude. Also, a similar increase in the R-square is found when DMERVUs are included in the dependent variable.

Based on our analyses above, regardless of the DME policy, we include IME as a standardizing factor for both the standardized RVU amount and the prospective bundled physician payment. We apply results from the first specification in our standardization steps and payment adjustment (discussed in Section 4.2 below). Our estimates generally show that under the first policy option, medical staffs at teaching hospitals would receive negative adjustments to their bundled Part B physician payments for indirect medical education. Under our second policy option, hospitals would no longer receive Part A DME payments; rather, DME payments would be incorporated into the standardized amounts for DRG-based bundled Part B physician payments, and appropriate IME adjustments would be made to bundled physician payments. Our regression results indicate that under the second policy option, medical staffs in teaching hospitals would receive positive IME adjustments to their bundled physician payments.

Our analyses generally support a negative DSH adjustment, particularly for hospitals with the highest disproportionate shares. However, we believe that a negative DSH adjustment would not be prudent given the characteristics of the high DSH hospital group shown in Table 4-6. High DSH hospitals are more likely to be academic medical centers, urban public hospitals, or small rural hospitals, compared with hospitals generally. We suspect that these hospitals treat a disproportionate number of low-income patients, and that other poor Medicare patients receive less intensive or aggressive care or physicians in these hospitals simply may not be billing their poor patients. A negative DSH adjustment in these instances could make physician recruitment and retention more difficult, and exacerbate access to care problems. For this reason, we elected to not adjust physician payments for DSH status.

TABLE 4-6

## COMPARISON OF NUMBER OF HOSPITALS AND DISCHARGES BETWEEN HIGH DISPROPORTIONATE SHARE HOSPITALS AND ALL HOSPITALS, BY CHARACTERISTIC

| | HIGH DISPROPORTIONATE SHARE HOSPITALS (a) | | | | ALL HOSPITALS | | | |
|---|---|---|---|---|---|---|---|---|
| Hospital Type | Number of Hospitals | Percent of Hospitals | Number of Discharges | Percent of Discharges | Number of Hospitals | Percent of Hospitals | Number of Discharges | Percent of Discharges |
| OVERALL | 525 | 100 | 225,860 | 100 | 5,120 | 100 | 3,714,851 | 100 |
| **Teaching Status** | | | | | | | | |
| Academic Medical Center | 38 | 7.2 | 39,423 | 16.9 | 120 | 2.3 | 210,509 | 5.6 |
| COTH, Non-Academic | 24 | 4.6 | 24,647 | 10.6 | 174 | 3.3 | 368,841 | 9.8 |
| Other Teaching | 88 | 16.8 | 50,316 | 21.6 | 830 | 15.7 | 1,027,343 | 27.4 |
| Non-Teaching | 375 | 71.4 | 118,228 | 50.8 | 4,057 | 76.9 | 2,136,041 | 56.9 |
| **Urban/Rural Status** | | | | | | | | |
| Large Urban | 183 | 33.7 | 113,246 | 48.4 | 1,613 | 30.6 | 1,661,459 | 44.3 |
| Other Urban | 101 | 18.6 | 47,071 | 20.1 | 1,310 | 24.8 | 1,316,775 | 35.1 |
| Rural | 259 | 47.7 | 73,619 | 31.5 | 2,354 | 44.6 | 775,087 | 20.7 |
| **Region** | | | | | | | | |
| New England | 5 | 0.9 | 1,338 | 0.6 | 218 | 4.1 | 207,651 | 5.5 |
| Mid Atlantic | 38 | 7.0 | 34,380 | 14.7 | 532 | 10.1 | 631,684 | 16.8 |
| South Atlantic | 107 | 19.7 | 54,113 | 23.1 | 787 | 14.9 | 715,576 | 19.1 |
| East North Central | 29 | 5.3 | 16,796 | 7.2 | 792 | 15.0 | 660,108 | 17.6 |
| East South Central | 113 | 20.8 | 39,225 | 16.8 | 454 | 8.6 | 315,312 | 8.4 |
| West North Central | 20 | 3.7 | 5,106 | 2.2 | 753 | 14.3 | 302,948 | 8.1 |
| West South Central | 113 | 20.8 | 43,289 | 18.5 | 729 | 13.8 | 404,580 | 10.8 |
| Mountain | 25 | 4.6 | 3,875 | 1.7 | 369 | 7.0 | 154,787 | 4.1 |
| Pacific | 93 | 17.1 | 35,814 | 15.3 | 643 | 12.2 | 360,675 | 9.6 |
| **Bed Classes** | | | | | | | | |
| Rural, Beds <50 | 116 | 22.7 | 17,253 | 7.7 | 1,155 | 21.9 | 143,344 | 3.8 |
| Rural, Beds 50-99 | 88 | 17.3 | 28,203 | 12.6 | 707 | 13.4 | 242,012 | 6.4 |
| Rural, Beds 100-169 | 32 | 6.3 | 16,617 | 7.4 | 286 | 5.4 | 192,916 | 5.1 |
| Rural, Beds >169 | 12 | 2.4 | 12,779 | 5.7 | 161 | 3.1 | 208,803 | 5.6 |
| Urban, Beds <100 | 66 | 12.9 | 10,925 | 4.9 | 653 | 12.4 | 170,255 | 4.5 |
| Urban, Beds 100-199 | 89 | 17.5 | 34,522 | 15.4 | 855 | 16.2 | 575,678 | 15.3 |
| Urban, Beds 200-299 | 35 | 6.9 | 22,504 | 10.0 | 616 | 11.7 | 763,579 | 20.3 |
| Urban, Beds 300-404 | 38 | 7.5 | 36,102 | 16.1 | 358 | 6.8 | 583,686 | 15.6 |
| Urban, Beds 405-504 | 18 | 3.5 | 20,100 | 8.9 | 163 | 3.1 | 341,019 | 9.1 |
| Urban, Beds >504 | 16 | 3.1 | 25,714 | 11.4 | 180 | 3.4 | 503,143 | 13.4 |
| **Ownership** | | | | | | | | |
| Voluntary | 181 | 35.4 | 104,514 | 46.3 | 3,026 | 57.3 | 2,770,839 | 73.8 |
| Proprietary | 116 | 22.7 | 42,769 | 18.9 | 698 | 13.2 | 421,491 | 11.2 |
| Government Non-Federal | 214 | 41.8 | 78,577 | 34.8 | 1,396 | 26.5 | 522,521 | 13.9 |

NOTE:

(a) Disproportionate share > 0.45

SOURCE Health Economics Research, Inc analysis of the Episode Database, PPS-6 and Impact File data

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### 4.1.6 Geographic Adjustments

Under the Medicare Fee Schedule, geographic practice cost indices (GPCIs) are multiplied by each RVU component (work, practice expense, malpractice expense) to account for variation in practice input costs assumed to be beyond the control of physicians. Using the design of the MFS as one of our guiding principles, in our bundled payment models we utilize the most recent GPCIs to adjust the RVU components in the PSO and FPS models. These GPCIs are the fully phased-in GPCIs (work, practice expense, malpractice expense) that will be operational October 1, 1995 (Pope and Dayhoff, 1994; Pope *et al.* 1994; Zuckerman and Norton, 1994).

GPCIs were merged onto each record within a hospital according to the payment locality of the hospital, and then applied to the RVUs for each service to create geographically-adjusted RVUs for each service. However, individual RVU components were not derived for transfer cases and outliers, therefore we computed geographic adjustment factors (GAFs) within each payment locality. Within a given payment locality, all transfer cases and outlier RVUs across all DRGs will receive the same GAF. GAFs vary only by Medicare payment locality. Each GAF is a weighted average of the three GPCI components, where the weights for each component are the corresponding RVU share of the total RVUs over the entire file. (We describe this methodology in more detail in Section 4.2.5.)

## 4.2 Development of the PSO and FPS Models

The three RVU components--work, practice expense, and malpractice expense-- were merged onto each CPT/modifier combination in our file, including records pre- and post-discharge. For both the PSO and FPS models, we included only those RVUs associated with services provided during the inpatient stay window in our calculation of mean RVUs per DRG. Specifically, we summed up all RVUs for all services per discharge for each DRG, then we divided this sum by the number of discharges within each DRG.

### 4.2.1 Statistical Trims

We eliminated high statistical extremes greater than three standard deviations above the RVU mean for each DRG, or 52,759 out of 3,813,385 (1.36%) under the first DME policy option and 55,334 (1.33%) under the second. Low "extremes" were not eliminated, however. In the original construction of the PPS cost weights, Pettengill and Vertrees (1982) dropped cases whose costs exceeded three deviations times the geometric mean for each DRG. Such "trimming" is symmetric, that is, it drops both very expensive and very inexpensive cases. It is our belief that similar "trimming" is unnecessary for physician payment and could even distort the cost weights. While both extremely low and extremely high costs for hospital inpatients may be seen as outliers or "bad" data, this is not the case for physician costs. A small number of episodes have no associated physician bills (because services were provided by residents, or a decision was made to not submit a bill because of the patient's low income status); in these cases, physician costs are legitimately zero (i.e. they are not outliers). Thus, we trimmed only for extreme high RVU cases based on statistical criteria before calculating the RVU weights for each DRG.

In addition, as discussed above in Section 4.1.2, we found that 62 different DRGs in our file were determined to have volumes insufficient to statistically support a DRG RVU weight. We imputed weights for 49 DRGs, while dropping only 13 DRGs (12 low volume DRGs plus DRG 470).

### 4.2.2 Calculation of Standardized Amounts, DRG RVU Weights and CMIs

After trimming extremely high RVU cases and eliminating low-volume DRGs, we proceeded to calculate standardized RVU amounts, DRG RVU weights, and CMIs based on physician services for each medical staff. A multi-stage process was utilized and is described below.

A problem of circularity arises when attempting to standardize average RVUs per case by IME. The IME adjustment uses casemix in the regression, and casemix is derived using RVU weights. However, the RVU weights should be based on average RVUs standardized by IME. The optimal solution to this quandary is to develop a system of simultaneous equations and solve for the parameters based upon convergence of the model. Due to the large size of our data file and the inherent complexity of such a method, our approach is to use a sequential model whereby we employ three stages as part of the first phase. RVU means, standardized RVU amounts, DRG RVU weights, CMIs, and IME adjustments are created in the first phase, while in the second phase we integrate adjustments from the outlier policy work. (Final RVU weights for each DRG and standardized RVU amounts for both models are shown in Appendix B).

In the first stage in Phase I we conducted the following steps:

Step 1: Calculate the first round preliminary unstandardized RVU amount as follows.

a) Calculate the unadjusted mean RVUs per case for each DRG:

$$mean\ RVU_{i;d} = \frac{\sum_{i=1}^{n} (RVU_w + RVU_{pe} + RVU_m)_{i;d}}{n_i} \tag{3}$$

where i = i-th case in the d-th DRG; and n is the total number of discharges.

b) Calculate an overall national unadjusted mean RVU per case:

$$U.S.mean\ RVU_i = \frac{\sum_{d=1}^{D}\sum_{i=1}^{n} (RVU_w + RVU_{pe} + RVU_m)_{i;d}}{\text{total U.S. cases}} \tag{4}$$

where D is the total number of DRGs.

Step 2: Calculate RVU weights for each DRG:

$$RVUWT_d = \frac{(RVU\ MEAN)_d}{\sum_{d=1}^{D}\sum_{i=1}^{n} (RVU_w + RVU_{pe} + RVU_m)_{i;d}\ /\ \text{total U.S. cases}} \tag{5}$$

Step 3: Calculate a casemix index for each medical staff.

$$CMI\ RVU_h = \frac{\sum_{d=1}^{D} RVUWT_d * PROPORTION_{d,h}}{\sum_{h=1}^{H}\sum_{d=1}^{D} RVUWT_d * PROPORTION_{d,h}\ /\ H} \tag{6}$$

where $PROPORTION_{d,h}$ is the proportion of cases in the d-th DRG in the h-th hospital; and H is the total number of hospitals in the U.S.

Step 4: Run a regression (at the hospital level) to calculate the teaching intensity coefficient for the IME adjustment. The dependent variable is the natural log of RVUs per case adjusted by the CMI and the independent variables include: natural log of hospital beds, natural log of the hospital's disproportionate share percentage, and dummy variables for large MSA size, mid-size MSA, and small MSA.

The IME coefficient from this regression model (under the payment model using the first DME policy, which retains the current Medicare PPS policy) is -0.526. The IME percent adjustment term used for each teaching medical staff is calculated according to:

$$IMEPCT\ adjustment = [(1 + IRB)^{(-.526)} - 1].$$

where IRB is the intern-bed ratio for each hospital. This is the curvilinear formula used for the PPS Part A IME adjustment, except here we have substituted -.526 for the IRB coefficient of 0.405 according to our regression results.[6] In the model using the second DME policy option, the IRB coefficient is 0.714. The curvilinear equation in the second model therefore becomes:

$$IMEPCT\ adjustment = [(1 + IRB)^{(+.714)} - 1].$$

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[6] Under the current Medicare IME policy, the IME adjustment to Part A PPS payments is derived as:

$$IME\ adjustment = 1.89 * [(1 + IRB)^{0.405} - 1].$$

We do not include a term comparable to 1.89. Under PPS, the 1.89 term originally served as an adjustment term to achieve a target level for total IME expenditures.

In the second stage in Phase I we conducted the following steps:

Step 1: Calculate a preliminary standardized RVU amount as follows.

a) Calculate adjusted mean RVUs per case for each DRG:

$$mean\ adjusted\ RVU_{i;d} = \frac{\sum_{i=1}^{n} (RVU_w + RVU_{pe} + RVU_m)_{i;d} / (1 + IMEPCT_h)}{n_i} \tag{7}$$

b) Calculate the second round overall national adjusted mean RVU per case using the preliminary IME-adjusted RVUs.

Step 2: Calculate second round RVU weights for each DRG using RVUs adjusted for IMEPCT.

Step 3: Calculate second round casemix indexes for each medical staff using RVUs and weights adjusted for IMEPCT.

Step 4: Rerun the IME regression using the revised CMI to calculate the teaching intensity coefficient for the IME adjustment and respecify the IME curvilinear equation.[7]

In the third stage, we repeat steps 1, 2, and 3 to yield Phase I standardized RVUs, RVU weights for each DRG, and CMIs for each medical staff. The U.S. mean adjusted RVU per case is the sum of the national standardized amounts for the work, practice expense, and malpractice expense components. These three standardized components are expressed as:

$$STNDRVU_{US}^{w} = \frac{\sum_{d}^{D} \sum_{i=1}^{n} (RVU_w)_{i,d} / (1 + IMEPCT_{i;h})}{\text{total U.S. cases}} \tag{8}$$

---

[7] The final IME percentage adjustment is based on the curvilinear equation using -.614 as the IRB coefficient for the model without DMERVUs, and +.773 for the model including DMERVUs.

where $STNDRVU^{w}_{US}$ is the national standardized amount for the work RVU component;

$$STNDRVU_{US}^{pe} = \frac{\sum_{d}^{D}\sum_{i=1}^{n}(RVU_{pe})_{i,d} / (1 + IMEPCT_{i;h})}{\text{total U.S. cases}} \tag{9}$$

where $STNDRVU^{pe}_{US}$ is the national standardized amount for the practice expense RVU component; and

$$STNDRVU_{US}^{m} = \frac{\sum_{d}^{D}\sum_{i=1}^{n}(RVU_{m})_{i,d} / (1 + IMEPCT_{i;h})}{\text{total U.S. cases}} \tag{10}$$

where $STNDRVU^{m}_{US}$ is the national standardized amount for the malpractice expense RVU component. Retaining the three individual components is necessary to compute final fees adjusted for geographic input price differences.

In Phase II, we calculate outlier RVU amounts according to our fixed loss outlier policy. Outlier payments emanate from an expected outlier pool. Contributions to this pool are made on a DRG specific basis in our model. These contributions require adjustments to our model parameters (discussed in the following section). However, we did not adjust for outlier contributions in Phase I. Theoretically, outliers and outlier contributions for each DRG would be derived as part of a larger system of equations. Again, we chose to follow a sequential process in deriving outliers and outlier contributions.

### 4.2.3 Outliers

The first step in developing the actual outlier payment policy is to determine the size of the outlier payout pool. We set the outlier pool to be 5 percent of the total payments in the system, which is comparable to Medicare's PPS outlier pool size. The next step was to set the amount to be paid above the outlier threshold. Eighty percent was selected as the amount to be paid to medical staffs for cases with costs above the threshold, which is consistent with the current PPS cost outlier policy.

Using the five percent outlier pool, we calculated the appropriate fixed loss amount, or deductible, in RVU terms that would yield the five percent payout. In order to maintain the 5 percent payout target, the initial pool was increased to 6.25 percent for the 80 percent policy. A pool of 6.25 percent would effectively lower the fixed loss amount, raising the number of cases that qualify as outliers. However, all cases are paid at 80 percent of their excess RVUs above the new, lower threshold. By paying 80 percent of a pool of 6.25 percent, the 5 percent target is maintained (5% = 6.25% x 80%).

Table 4-7 shows the fixed loss amount, mean DRG RVU amount, mean outlier threshold, number of outlier cases, total cases, and percent outlier cases for the PSO model under both DME policy options. For the model without [with] DMERVUs, the fixed loss amount is 33.3 RVUs [34.65 RVUs], while the average DRG RVU amount is 34.01 [35.84]. In dollar terms, the fixed loss amount is $1,214.18 (= $36.46 * 33.3) and $1,273.96 (= $36.76 * 34.65) for the model without and with DMERVUs, respectively. Thus, on average, under the model without [with] DMERVUs, a case must incur over 67.31 RVUs [70.49 RVUs], or $2,454.40 [$2,5[illegible].78] to qualify as an outlier case, where the mean threshold is the fixed loss amount (33.3 for the model without DMERVUs; 34.65 with DMERVUs) plus the average DRG RVU amount (34.01 without DMERVUs; 35.84 with DMERVUs). Note that the threshold does vary by DRG because the mean RVU amount will vary across DRGs. The model without DMERVUs has 280,162 outlier cases while the model with DMERVUs has 284,560, or 7.45 percent and 7.57 percent of the total cases, respectively.

Tables 4-8 and 4-9 show the distribution of outlier cases and RVUs by hospital characteristic for the PSO model without and with DMERVUs. Voluntary hospitals, large urban hospitals, and teaching hospitals all have above-average number of outlier cases as a percentage of their total, while non-federal government hospitals, non-teaching, and rural hospitals are below the national average in both models. Voluntary hospitals account for 73.8 percent of total cases and 79.5 percent of the total outlier payout. Non-federal government hospitals treat 13.9 percent of total cases in both models while receiving 9.7 percent and 8.7 percent of total outlier payments in the model without and with DMERVUs, respectively.

The largest urban hospitals treat 44 percent of all cases, with 10 percent of their cases qualifying for outlier payments, accounting for 62 percent of the total outlier pool. In contrast, rural hospitals treat 20.6 percent of all cases and have slightly more than 2 percent of their cases as outliers. However, rural hospital outliers receive about 5 percent of the total outlier pool.

Academic medical centers have 15.3 percent and 12.3 percent of their cases as outliers in the model without and with DMERVUs, respectively. While academic medical centers treat 5.5 percent [5.3%] of all cases, they receive 15.6 percent [9.2%] of all outlier payments in the model without [with] DME RVUs. Non-teaching hospitals, on the other hand, have about 5 percent of cases as outliers in the two models.

Among the different regions, the Mid-Atlantic has substantially more outliers than other regions--about 69,000 (10.9%) and 73,500 (11.7%) in the model without and with

TABLE 4-7

## FIXED LOSS AMOUNT, MEAN DRG AMOUNT, MEAN OUTLIER THRESHOLD, AND NUMBER OF OUTLIER CASES

| | Model Excluding DME RVUs | Model Including DME RVUs |
|---|---|---|
| **Fixed Loss Amount** | | |
| RVUs | 33.30 | 34.65 |
| Dollars | $1,214.18 | $1,273.96 |
| **Mean DRG Amount** | | |
| RVUs | 34.01 | 35.84 |
| Dollars | $1,240.22 | $1,317.82 |
| **Mean Outlier Threshold** | | |
| RVUs | 67.31 | 70.49 |
| Dollars | $2,454.40 | $2,591.78 |
| **Outlier Cases** | | |
| Total | 280,162 | 284,560 |
| Percent | 7.45% | 7.57% |
| **All Cases** | 3,760,626 | 3,758,051 |

**NOTES:**

Conversion factors are $36.46 and $36.76 for the model excluding and including DMERVUs.

Outlier policy is based on a 5% payout pool and payment of 80% above outlier thresholds.

SOURCE: HER analysis of the 1992 Episode Data Base, 1995 Impact File, and HCRIS PPS-8 and PPS-7 data.

TABLE 4-8

## INCIDENCE OF OUTLIERS BY HOSPITAL TYPE (model without DME)

| | DISCHARGES | | | RELATIVE VALUE UNITS | | | | |
|---|---|---|---|---|---|---|---|---|
| Hospital Type | Total | Outliers | Percent Outlier Cases | Overall | Nonoutlier | Outlier (a) | Outlier RVUs | Total Outlier RVUs |
| **All** | 3,760,626 | 280,162 | 7.45 | 34.7 | 32.8 | 57.9 | 23.3 | 6,519,370 |
| **Teaching Status** | | | | | | | | |
| Academic Medical Center | 210,509 | 32,169 | 15.38 | 44.8 | 39.6 | 68.9 | 31.5 | 1,014,065 |
| COTH, Non-Academic | 372,205 | 46,266 | 12.43 | 41.0 | 37.3 | 63.1 | 26.7 | 1,236,534 |
| Other Teaching | 1,030,150 | 91,100 | 8.84 | 37.4 | 35.2 | 57.2 | 22.6 | 2,060,082 |
| Non-Teaching | 2,147,762 | 110,627 | 5.15 | 31.6 | 30.4 | 53.2 | 20.0 | 2,211,479 |
| **Urban/Rural Status** | | | | | | | | |
| Large Urban | 1,662,376 | 165,246 | 9.94 | 36.4 | 33.7 | 58.1 | 24.5 | 4,045,633 |
| Other Urban | 1,316,271 | 95,936 | 7.28 | 37.0 | 35.1 | 59.3 | 22.5 | 2,155,732 |
| Rural | 775,416 | 18,642 | 2.40 | 28.0 | 27.4 | 49.4 | 16.8 | 313,051 |
| **Region** | | | | | | | | |
| New England | 207,877 | 14,894 | 7.16 | 34.0 | 31.9 | 58.5 | 22.9 | 341,713 |
| Mid Atlantic | 631,868 | 68,994 | 10.91 | 33.9 | 31.2 | 53.0 | 23.0 | 1,587,302 |
| South Atlantic | 715,576 | 52,661 | 7.35 | 35.4 | 33.5 | 57.3 | 22.6 | 1,190,464 |
| East North Central | 660,108 | 48,086 | 7.28 | 34.6 | 32.5 | 58.9 | 23.5 | 1,130,173 |
| East South Central | 315,462 | 17,954 | 5.69 | 32.5 | 30.9 | 56.3 | 21.5 | 386,261 |
| West North Central | 302,959 | 17,867 | 5.89 | 35.2 | 33.4 | 62.3 | 24.6 | 440,375 |
| West South Central | 404,952 | 25,059 | 6.18 | 34.6 | 32.9 | 59.3 | 22.9 | 572,688 |
| Mountain | 154,792 | 8,573 | 5.53 | 37.1 | 35.3 | 65.3 | 24.4 | 208,938 |
| Pacific | 361,069 | 25,736 | 7.12 | 37.3 | 35.1 | 64.3 | 25.5 | 656,502 |
| **Bed Classes** | | | | | | | | |
| Rural, Beds <50 | 143,652 | 800 | 0.55 | 22.8 | 22.7 | 38.1 | 12.4 | 9,925 |
| Rural, Beds 50-99 | 242,012 | 3,237 | 1.33 | 26.1 | 25.9 | 44.5 | 13.4 | 43,444 |
| Rural, Beds 100-169 | 192,937 | 5,112 | 2.64 | 29.5 | 29.0 | 47.6 | 15.7 | 80,499 |
| Rural, Beds >169 | 208,803 | 10,536 | 5.05 | 33.2 | 32.0 | 54.3 | 19.2 | 202,695 |
| Urban, Beds <100 | 171,161 | 5,626 | 3.28 | 27.9 | 27.3 | 45.0 | 16.3 | 91,821 |
| Urban, Beds 100-199 | 576,734 | 35,926 | 6.22 | 32.1 | 30.8 | 50.1 | 19.4 | 697,816 |
| Urban, Beds 200-299 | 764,555 | 61,451 | 8.03 | 35.4 | 33.6 | 54.8 | 21.8 | 1,337,124 |
| Urban, Beds 300-404 | 583,686 | 54,609 | 9.35 | 37.6 | 35.2 | 58.4 | 23.5 | 1,285,674 |
| Urban, Beds, 405-504 | 342,559 | 36,430 | 10.63 | 40.2 | 37.2 | 62.2 | 25.4 | 925,471 |
| Urban, Beds >504 | 504,967 | 64,583 | 12.78 | 43.2 | 39.3 | 65.7 | 27.8 | 1,794,887 |
| **Ownership** | | | | | | | | |
| Federal | 7,313 | 493 | 6.74 | 33.2 | 31.9 | 49.7 | 21.3 | 10,480 |
| Voluntary | 2,774,164 | 222,167 | 8.00 | 35.6 | 33.5 | 58.1 | 23.3 | 5,180,642 |
| Proprietary | 422,435 | 29,338 | 6.94 | 34.2 | 32.5 | 55.5 | 22.0 | 644,185 |
| Government, Non-Federal | 524,886 | 26,189 | 4.99 | 31.3 | 29.8 | 59.2 | 24.2 | 633,818 |

**NOTES:**

All means are unweighted
Fixed loss "deductible" is 33 3 RVUs

(a) Values represent RVUs for outlier cases up to the outlier threshold, thus outlier RVUs are excluded

SOURCE. HER analysis of the 1992 Episode Data Base

TABLE 4-9

INCIDENCE OF OUTLIERS BY HOSPITAL TYPE (model with DME)

| | DISCHARGES | | | RELATIVE VALUE UNITS | | | | |
|---|---|---|---|---|---|---|---|---|
| Hospital Type | Total | Outliers | Percent Outlier Cases | Overall | Nonoutlier | Outlier (a) | Outlier RVUs | Total Outlier RVUs |
| **All** | 3,758,051 | 284,560 | 7.57 | 35.8 | 34.2 | 55.8 | 23.5 | 6,681,184 |
| **Teaching Status** | | | | | | | | |
| Academic Medical Center | 200,215 | 24,592 | 12.28 | 45.5 | 42.5 | 63.8 | 25.0 | 614,731 |
| COTH, Non-Academic | 365,217 | 46,722 | 12.79 | 41.9 | 39.1 | 57.8 | 24.8 | 1,156,573 |
| Other Teaching | 1,030,981 | 102,258 | 9.91 | 38.4 | 36.4 | 54.9 | 23.6 | 2,417,161 |
| Non-Teaching | 2,161,638 | 110,988 | 5.13 | 33.0 | 31.8 | 54.1 | 22.5 | 2,492,797 |
| **Urban/Rural Status** | | | | | | | | |
| Large Urban | 1,654,993 | 166,138 | 10.03 | 37.5 | 35.2 | 55.3 | 24.1 | 4,002,133 |
| Other Urban | 1,319,883 | 100,061 | 7.58 | 38.0 | 36.2 | 57.7 | 23.4 | 2,340,534 |
| Rural | 777,145 | 18,361 | 2.36 | 29.5 | 29.0 | 50.0 | 18.4 | 338,594 |
| **Region** | | | | | | | | |
| New England | 206,886 | 13,983 | 6.75 | 35.1 | 33.6 | 53.8 | 21.2 | 296,097 |
| Mid Atlantic | 625,987 | 73,533 | 11.74 | 35.0 | 32.8 | 49.6 | 22.7 | 1,670,582 |
| South Atlantic | 717,327 | 52,811 | 7.36 | 36.6 | 34.8 | 56.7 | 23.9 | 1,263,956 |
| East North Central | 658,586 | 48,297 | 7.33 | 35.8 | 34.0 | 56.1 | 22.6 | 1,091,864 |
| East South Central | 316,634 | 18,702 | 5.91 | 33.7 | 32.2 | 55.9 | 23.2 | 433,462 |
| West North Central | 302,610 | 18,488 | 6.11 | 36.3 | 34.7 | 60.2 | 24.2 | 447,492 |
| West South Central | 406,198 | 25,377 | 6.24 | 35.8 | 34.2 | 58.9 | 24.2 | 614,236 |
| Mountain | 155,189 | 8,573 | 5.52 | 38.1 | 36.4 | 64.6 | 25.3 | 217,078 |
| Pacific | 362,604 | 24,796 | 6.83 | 38.4 | 36.4 | 63.5 | 26.2 | 650,303 |
| **Bed Classes** | | | | | | | | |
| Rural, Beds <50 | 143,762 | 735 | 0.51 | 24.5 | 24.4 | 39.5 | 14.4 | 10,555 |
| Rural, Beds 50-99 | 242,359 | 3,028 | 1.25 | 27.8 | 27.5 | 45.6 | 15.0 | 45,464 |
| Rural, Beds 100-169 | 193,459 | 5,050 | 2.61 | 31.0 | 30.6 | 48.4 | 17.6 | 88,724 |
| Rural, Beds >169 | 209,614 | 10,593 | 5.05 | 34.4 | 33.3 | 54.2 | 20.6 | 218,327 |
| Urban, Beds <100 | 171,771 | 5,332 | 3.10 | 29.4 | 28.9 | 45.2 | 18.0 | 96,037 |
| Urban, Beds 100-199 | 580,033 | 37,247 | 6.42 | 33.5 | 32.2 | 50.0 | 21.4 | 796,791 |
| Urban, Beds 200-299 | 767,968 | 65,273 | 8.49 | 36.6 | 34.8 | 54.0 | 23.2 | 1,517,001 |
| Urban, Beds 300-404 | 584,611 | 57,317 | 9.80 | 38.6 | 36.4 | 57.0 | 24.2 | 1,389,761 |
| Urban, Beds, 405-504 | 339,194 | 36,273 | 10.69 | 41.0 | 38.7 | 58.2 | 24.5 | 887,138 |
| Urban, Beds >504 | 496,289 | 62,534 | 12.60 | 43.9 | 41.0 | 61.1 | 25.5 | 1,597,288 |
| **Ownership** | | | | | | | | |
| Federal | 7,382 | 488 | 6.61 | 34.6 | 33.4 | 50.7 | 25.7 | 12,527 |
| Voluntary | 2,771,715 | 227,848 | 8.22 | 36.7 | 34.8 | 55.7 | 23.4 | 5,333,883 |
| Proprietary | 425,125 | 29,894 | 7.03 | 35.5 | 33.8 | 56.1 | 24.3 | 725,034 |
| Government, Non-Federal | 522,434 | 25,258 | 4.83 | 32.6 | 31.3 | 56.9 | 23.0 | 581,856 |

**NOTES:**

All means are unweighted
Fixed loss "deductible" is 34 65 RVUs

(a) Values represent RVUs for outlier cases up to the outlier threshold, thus outlier RVUs are excluded

SOURCE: HER analysis of the 1992 Episode Data Base

DMERVUs, respectively. Hospitals in regions in the western half of the U.S. all have below average outlier percentages and totals, except for the Pacific region.

We show the distribution of outlier cases and outlier RVUs in the models without and with DMERVUs, respectively, in Tables B-1 and B-2, which are sorted by the number of outlier RVUs in descending order. In general, the top outlier DRGs tend to be surgical. Given the fixed loss outlier policy in the payment system, this result is not surprising. In Table B-1, the top DRG in terms of total outlier RVUs is DRG 483, tracheostomy for face, mouth and neck, with 347,171 outlier RVUs ($12.6 million) and 3,179 outlier cases, followed by DRG 148, major small and large bowel procedures with complicating conditions, with 9,750 outlier cases and 333,895 outlier RVUs ($12.2 million). DRG 127, heart failure and shock, has the most outlier cases (10,851; 4.5% of its total cases) and total cases, but ranks only 18th in terms of outlier payments with 101,609 ($3.5 million). The second highest total case volume DRG -- DRG 89, simple pneumonia and pleurisy, age greater than 17 with complicating conditions--ranks 42nd and has 5,212 outlier cases (3.7% of its total cases) and 38,111 outlier RVUs ($1.38 million). Outlier payments for DRG 483 account for 5.3 percent of the total outlier pool, and 18.3 percent of this DRG's own payments, while for DRG 148 the corresponding values are 5.1 percent and 7.9 percent, respectively. The top 10 DRGs account for over 36 percent of the total outlier pool, while Table B-2 shows the top 10 DRGs accounting for over 34 percent of the total outlier pool for the model with DMERVUs included.

### 4.2.4 Transfer Cases

We adopted a graduated per-diem payment policy for transfer cases (described more fully in Section 4.1.4). In brief, medical DRG cases transferred out by hospitals receive 150 percent of the per diem payment on the first day of stay, 125 percent of the per diem payment on the second day of stay, and the per diem payment for all subsequent days. Transfer payments are capped at the DRG payment for nontransfer cases. Surgical case receive only a per diem payment. Transfer cases are eligible for outlier payments according to the outlier policy criteria.

We calculated transfer payments by first deriving the basic DRG payment in the PSO model for each DRG. Per diem amounts for each DRG were then created by dividing the basic DRG payment by the geometric mean LOS for the corresponding DRG. Transfer payments for cases in surgical DRGs equal the per diem amount for the DRG multiplied by the LOS for the case and the corresponding GAF. If the calculated payment exceeds the basic DRG payment for the DRG then payment is limited to the basic DRG payment. For medical DRG cases, payment for a case transferred on the first day is 1.5 times the per diem payment, multiplied by the appropriate GAF. If the medical case is transferred on day two, the payment is 2.75 (= 1.5 for day 1 + 1.25 for day 2) times the per diem payment for the DRG. If the medical case is transferred after day two, it receives a per diem payment for each day beyond the second, plus 2.75 times the per diem amount. Outlier payments for transfer cases were calculated by multiplying the outlier RVUs by the conversion factor and appropriate GAF. IME adjustments for cases transferred from teaching hospitals were derived by multiplying the transfer payment plus any outlier payments by the IME percentage for the hospital.

### 4.2.5 Base Year Payment Rates

The payment model was developed using physician volume from 1992, RVUs from 1993, and fully-phased in GPCIs from 1995. The model was designed to simulate a payment system under 1995 conditions, assuming constant (1992) volume and mix of services. The base period payments were developed to be consistent with the 1995 policy framework. We did not use 1992 charges "aged" forward. Rather, we created our base year payments using a conversion factor under a fully phased-in Medicare fee schedule. By doing so, we can make appropriate comparisons between 1995 base period payments under a fee-for-service environment and a prospective case payment system in 1995.

Part B base year (1995) payments were calculated as follows. First, we merged on the fully phased-in GPCIs (work, practice expense, malpractice expense) that will be operational October 1, 1995 (Pope and Dayhoff, 1994; Pope *et al.* 1994; Zuckerman and Norton, 1994) to each record within a hospital according to the payment locality of the hospital. Second, we applied GPCIs to the RVUs for each service (GAFs were applied to transfer and outlier RVUs) to yield total adjusted RVUs for each service. Summing over all services produces the grand total GPCI-adjusted RVU amount for the file.

Individual RVU components were not derived for transfer cases and outliers, therefore we computed geographic adjustment factors (GAFs) within each payment locality.[8] Thus, within a given payment locality, all transfer cases across all DRGs will receive the same GAF. GAFs vary only by Medicare payment locality. Each GAF is a weighted average of the three

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[8] Under the PSO model, with and without DMERVUs, we calculate payment locality GAFs using the national RVU proportions because DRG specific RVU proportions did not vary significantly from the national proportions. We assume that DMERVUs are split into the same proportion as the national. In doing so, we do not alter the RVU component proportions.

GPCI components, where the weights for each component are the corresponding RVU share of the total RVUs (over the entire file). That is, the GAF for the a-th payment locality ($GAF_a$) is derived as:

$$GAF_a = \frac{RVU_w}{\sum_j RVU_j} * GPCI_{w;a} + \frac{RVU_{pe}}{\sum_j RVU_j} * GPCI_{pe;a} + \frac{RVU_{m.d}}{\sum_j RVU_j} * GPCI_{m;a} \qquad (11)$$

where j = the three RVU components combined, work, practice expense, and malpractice expense.

The next major step was to calculate a conversion factor. In 1995, there [illegible] three separate conversion factors for surgical services ($39.45), primary care services ($36.38), nonsurgical/primary care services ($34.62), and anesthesia services. A single conversion factor was created by taking the weighted average of the 1995 surgical service CF, primary care CF, and nonsurgical/primary care CF, where the weights were the relative RVU share of the total RVU amount in the analytic file:

$$CF_{base\ year} = 39.45 * \frac{total\ RVU_{surg}}{\sum_k RVU_k} + 36.38 * \frac{total\ RVU_{prim}}{\sum_k RVU_k} + 34.62 + \frac{total\ RVU_{nonsurg}}{\sum_k RVU_k} \qquad (12)$$

where subscript k is surgical, primary care, and nonsurgical/nonprimary care service types. Our analytic file contains RVU-equivalents for some anesthesia services (see Mitchell, *et al.* 1995 for more detail). The anesthesia service RVUs were scaled to be on par with all other services in the file. The base year CFs are:

- $36.4136 (in the model without DMERVUs); and
- $36.4083 (in the model with DMERVUs).

After creating the weighted average base year CFs, we multiplied each by the total number of RVUs, adjusted by their respective GPCIs and GAFs, to yield total base year payments for both models.

### 4.2.6 PSO and FPS Model Per Case Payments

Per case payments for particular discharges are calculated by first multiplying each of the three national standardized RVU amounts (work, practice expense, malpractice expense) by their respective GPCIs. This sum is then multiplied by the DRG-based episode weight per DRG (RVUWT). Outlier payments, adjusted by the respective GAF, are then added to this product, and this new sum is multiplied by one plus an indirect medical education factor before being multiplied by a conversion factor (CF):

$$\begin{aligned} Case\ payment_{k,h,d,a} = CF * [RVUWT_{d,a} * (STNDRVU^{w}_{US} * GPCI^{a}_{w} + STNDRVU^{pe}_{US} * GPCI^{a}_{pe} + STNDRVU^{m}_{US} \\ * GPCI^{a}_{m}) + \alpha * OUTRVU_{k,d} * GA' ] * (1 + IMEPCT_{h}) \end{aligned} \tag{13}$$

where Case $\text{payment}_{k,h,d,a}$ is the payment for the k-th case in DRG d in hospital h in area a; $STNDRVU^{w}_{us}$, $STNDRVU^{pe}_{us}$, and $STNDRVU^{m}_{us}$ are the national standardized RVU amounts for the work, practice expense and malpractice expense components, respectively; $OUTRVU_{k,d}$ = actual outlier RVUs for the k-th patient in DRG d; and $\alpha = 0.8$ according to the 80 percent outlier payment policy. If no outlier or indirect medical payments are made, then IMEPCT and OUTRVU are both zero and payment simply involves a basic DRG payment (i.e., relative RVU weight times the standardized RVU total per case), adjusted for geographic input price differences. The budget neutral conversion factor used in equation (13) is simply the total number of Part B payments from the base period ($CF_{base}$ * total $RVUs_{base}$) divided by the total number of RVUs in the per case payment model (total $RVUs_{per\ case}$):

$$CF_{PSO} = \frac{CF_{base} * total\ RVUs_{base}}{total\ RVUs_{PSO}} \tag{14}$$

The budget neutral PSO model conversion factor ($CF_{PSO}$) will not necessarily be equivalent to the base year CF because of the various payment policies included in the prospective payment model. PSO model CFs are:

- $36.4619 (in the model without DMERVUs); and
- $36.7664 (in the model with DMERVUs).

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